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SHUTTLE ORBITER OV-102 CDR  
SAFETY ANALYSIS REPORT  
VOLUME VI  
AVIONICS SYSTEMS

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SAFETY ANALYSIS REPORT. VOLUME 6: AVIONICS  
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### ABSTRACT

Hazard Analyses are presented for each subsystem of the Shuttle Orbiter OV-102 configuration, and include: subsystem descriptions, safety features and hazard analysis printout tabs. This report, "Shuttle Orbiter OV-102 CDR Safety Analysis Report," is prepared per IRD SA-045T in support of OV-102 CDR, updated to April 29, 1977, and consists of the following volumes:

SD77-SH-0001-001, Volume I Management Summary  
SD77-SH-0001-002, Volume II Structural Systems  
SD77-SH-0001-003, Volume III Mechanical Systems  
SD77-SH-0001-004, Volume IV Propulsion Systems  
SD77-SH-0001-005, Volume V Power Systems  
SD77-SH-0001-006, Volume VI Avionics  
SD77-SH-0001-007, Volume VII Environment Control  
& Life Support  
SD77-SH-0001-008, Volume VIII Crew Station &  
Equipment

SD77-SH-0001-06

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## INTRODUCTION

This Safety Analysis Report (SAR) supports the OV-102 CDR. Related SAR's in the Shuttle Orbiter program series include:

|              |                                   |
|--------------|-----------------------------------|
| SD74-SH-0004 | Shuttle Orbiter No. 1 HFT SAR     |
| SD74-SH-0168 | Shuttle Orbiter 101 Delta PDR SAR |
| SD74-SH-0323 | Shuttle Orbiter 102 PDR SAR       |
| SD75-SH-0064 | Shuttle System PDR SAR            |
| SD75-SH-0135 | Shuttle Orbiter 101 CDR SAR       |
| SD76-SH-0038 | Shuttle Orbiter 102 Delta PDR SAR |

## HAZARD ANALYSIS PROCESS

The Hazard Analysis was performed per Rockwell International-Space Division, Reliability and Safety Desk Instruction 400-1. The hazard analysis process, shown in Figure 1, involves the evaluation of the Orbiter in its mission phases by subsystem identified by the System Definition Manual number for hazards in the major hazard groups described in the desk instruction and coded as listed below:

|                                  |    |
|----------------------------------|----|
| Illness/Injury/Loss of Personnel | AA |
| Collision/Impact/Erosion         | BB |
| Fire/Explosion/Implosion         | CC |
| Loss of/Unsafe Environment       | DD |
| Crash Landing/Ditching           | EE |
| Loss of Flight Control           | FF |
| Other (Not Defined)              | XX |

The status classifications presented in the summary are defined in the desk instruction and listed below:

|                 |                     |
|-----------------|---------------------|
| Open (In-Work)  | Closed (Eliminated) |
| Open (Residual) | Closed (Controlled) |
|                 | Closed (Accepted)   |

## HAZARD ANALYSIS GROUND RULES

Ground rules used for the hazard analysis are as follows:

1. Hazards are identified per the rationale stated in Desk Instruction 400-1 and NHB 5300.4 (1D-1).
2. Hazard analyses are conducted according to Desk Instruction 400-1 and NHB 5300.4 (1D-1).
3. Hazard levels are as stated in NHB 5300.4 (1D-1).
4. All Criticality 1 FMEA's are analyzed for hazards.
5. All other FMEA's are reviewed for identification of potential hazards.
6. Hazards requiring three or more failures will not be considered.
7. Unless stated in the hazard analysis, equipment is presumed to be operating per specification.



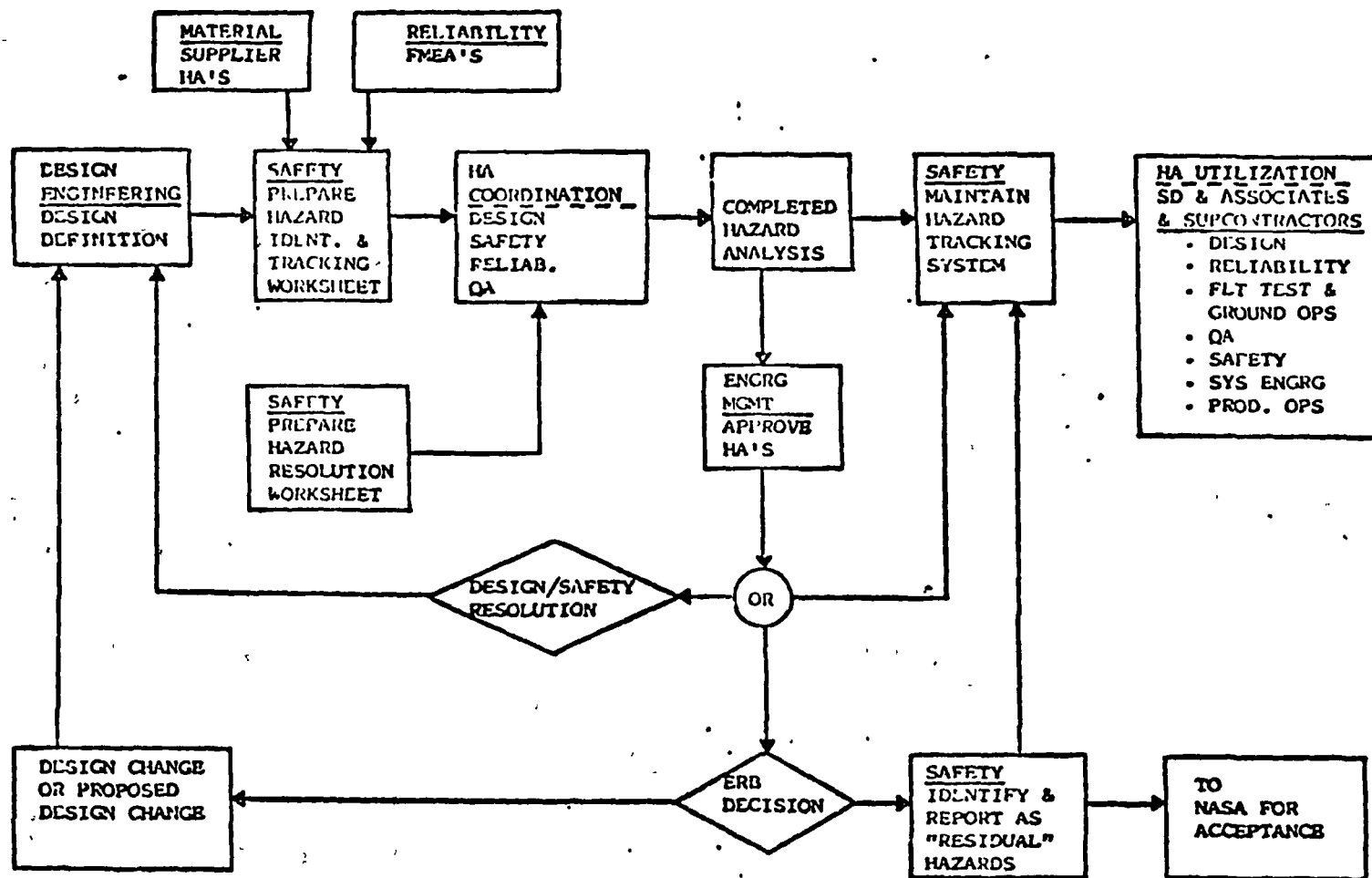


FIGURE 1 - HAZARD ANALYSIS PROCESS

## ORGANIZATION OF THE REPORT

The first section of the report is a description of the individual subsystems. These are very brief descriptions and they are intended to provide sufficient technical information so that the subsequent safety data and discussions are understandable to the reader who may not be familiar with the particular system.

The second section discusses safety features which are in the particular system. A discussion of the safeguards in the system is necessary to indicate the rationale of why particular potential hazards were not documented in the hazard analysis section. An additional feature of this section is to provide some general information on the Generic Hazard Groups derived from NHB 5300.4 for the specific subsystems. This data should be useful in terms of providing additional visibility and rationale involved in the hazard analysis selection process.

The third section is a summary of the individual hazard analyses. A discussion is given to the open, i.e., in-work or residual hazards which have not been closed out as of the date of this report. The current status and resolution plans for these open potential hazards is also briefly discussed. Three tables are also included in this summary section. Table I lists the number of HA's which have been generated for the individual hazard groups (Fire, Collision, etc.) for each of the subsystems. Table II is a tabulation of all the HA's in the particular volume. This list includes an identification number so that the reader can locate a particular potential hazard in the HA section of the document. This list also provides a descriptive title and current status for the individual potential hazards. It should be noted that a Catastrophic hazard is one in which no time exists to correct the problem, whereas in a Critical hazard situation time for corrective action is available. Table III is a Mission Phase Listing of the HA's.

The last section of the report contains the individual HA's which are arranged alpha-numerically by the identification numbers previously mentioned. This kind of listing results in the HA's being grouped by subsystem. Subsystem identifiers are also included on the top of the sheets to assist in locating specific items.

## SUBSYSTEM DESCRIPTIONS

### GENERAL

The Shuttle Orbiter (OV-102) avionics system provides the necessary signal acquisition, handling, processing, display and powering to enable the navigation, control, and information interchange required for the Operational Flight Test (OFT) Phase of the Orbiter Program. The OV-102 avionics system is shown in block diagrams in Figure 2 (VL70-000276) and consists of the following subsystems:

- Guidance Navigation & Control
- Communications & Tracking
- Displays & Controls
- Instrumentation - OFI/DFI
- Data Processing & Software
- Electrical Power Distribution & Control
- General Purpose Computer
- Performance Monitoring Function

### GUIDANCE NAVIGATION & CONTROL (GN&C)

The GN&C Subsystem is comprised of the Guidance and Navigation Group, the Air Data Group and the Flight Control Group.

#### Guidance and Navigation

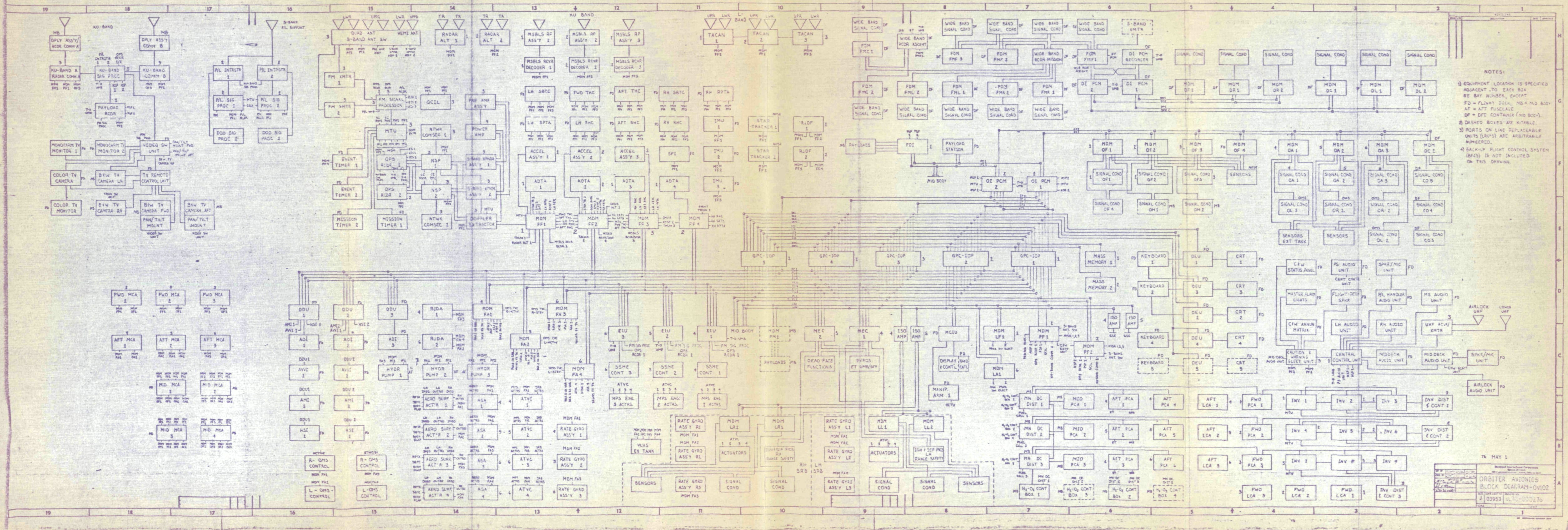
The Guidance and Navigation components consist of the hardware and software necessary to provide information on vehicle position, velocity, attitude, and angle of attack during all flight phases. The major assemblies include:

- Inertial Measuring Unit (IMU)
- Star Tracker and Light Shade (ST/LS)
- Navigation Base (NB)

The three IMU's are mechanized to supply vehicle attitude information and accumulated velocity change information. Each IMU consists of an all-attitude inertial stabilized platform and the associated platform electronics. The IMU's are under control of the general purpose computer and have a leveling and gyrocompassing capability in addition to the flight monitoring function.

The navigation base provides a rigid mounting for the three IMU's and the two star trackers whereby precision alignment of these critical navigation devices may be maintained throughout orbital flight.







## Air Data

The Air Data components provide sensory support for the Shuttle Orbiter navigation, guidance, flight control and crew display subsystems by measuring the following parameters:

- Static pressure
- Total (or pitot) pressure
- Upper alpha port pressure
- Lower alpha port pressure
- Indicated total air temperature

These parameters are transformed in the Air Data Transducer Assemblies to provide digital inputs to the on-board computer complex so that the following air data functions may be derived:

- Pressure altitude
- Pressure altitude rate
- True dynamic pressure
- Calibrated airspeed
- True airspeed
- Mach. number
- Angle of attack
- Static air temperature

There are two sets of aerodynamic sensors or probes, each set consists of a mast-mounted pitot-static probe and a mast-mounted alpha-total temperature probe. One set is mounted on the left side of the Orbiter forward fuselage and the other set is on the right side. The probes are mechanized for stowage within the Orbiter fuselage mold-line or for deployment beyond the mold-line into the airstream. Deployment is manual and is a function of computed ground relative velocity. The probes are contoured to reduce pitot and static defect errors to within specified limits. Residual defect error corrections will be accomplished in the air data processing software.

There are four ADTA's mounted in the forward fuselage avionics bays. Two ADTA's are coupled to the left side aerodynamic probes and two are coupled to the right side probes. Thus the subsystem is dual redundant insofar as aerodynamic sensors are concerned and dual-dual redundant insofar as ADTA's are concerned. The redundancy management of these elements is effected by software routines resident in the air data processing algorithms.

The capability exists to manually enter a barometric correction setting through a keyboard to the GN&C computer. This setting is used, prior to landing, to correct the computed pressure altitude function to standard sea-level conditions based on the up-linked barometric pressure existing at the landing site.

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## Flight Control

The flight control components provide automatic and manual control capability from launch through landing and runway rollout for orbital missions and for approach and landing flights of the Space Shuttle vehicle. The flight control components utilize vehicle-motion feedback sensors for stabilization and attitude control software and manual controllers as command generators; and drivers to control the effectors that include engine gimbals, reaction jets and aerodynamic-surface actuators. The flight control components (avionic-to-actuator interface) include:

- Rate gyro assembly
- Accelerometer assembly
- Rotation hand control
- Translation hand control
- Speed brake thrust control
- Rudder pedal transducer assembly
- Aerosurface servo amplifier
- Reaction jet driver forward
- Reaction jet/OMS driver
- Ascent thrust vector control (ATVC) driver

Additionally, flight control digital autopilot requirements will constitute the basic flight control mechanization for automatic and manual control in both the atmospheric and ex-atmospheric flight regimes of the Shuttle Orbiter system. The digital autopilot requirements will specify the on-board digital computations required to provide the following basic flight control functions:

- a. Stability augmentation
- b. Aerodynamic load relief and load limiting
- c. Acceleration, rate, and attitude response to commands
- d. Manual command augmentation
- e. Three-axis translational control
- f. Thrust vector control
- g. Trim control
- h. Turn coordination control
- i. Ground rollout control
- j. Attitude, attitude error, and body rate display
- k. Air data computation
- l. Fault detection, isolation, and redundancy management of above functions

## Backup Flight Control System (BFS)

A BFS system with dedicated software, a dedicated backup flight controller and non-redundant GPC, is provided to circumvent a generic software error in the primary flight redundant set GPC's. Navigation sensors, the data bus and the aerosurface or RCS actuation system are shared with the primary flight control system. Switch over to BFS requires positive crew action and is a one-way changeover for the dynamic mission phases. Once in-orbit, reconfiguring to the primary system is available with the present subsystem design configuration.

## COMMUNICATIONS AND TRACKING

The Communication and Tracking Subsystem consists of the RF, processing, and distribution equipment necessary to provide the following capabilities:

- a. Reception, transmission and distribution of Orbiter, ground and payload voice.
- b. Transmission of realtime and stored operational Pulse Code Modulation (PCM).
- c. Reception of payload PCM telemetry.
- d. Transmission of commands to payload(s).
- e. Receiving and channel-decoding of ground-to-Orbiter commands.
- f. Providing landing and atmospheric navigation RF aids and on-orbit tracking.
- g. Distribution and transmission of television signals.
- h. Tracking cooperative and passive targets.
- i. Installation and operation of GFE encryption and decryption equipment, TV equipment, and EVA/ATC equipment.
- j. Transmission of main engine PCM data.
- k. Transmission of payload data.

The Communication and Tracking Subsystem provides the capability to transmit and receive between the Orbiter and the following units, subject to the compatibility requirements of the applicable Interface Control Document:

- a. Other space vehicles and chase planes
- b. Payloads
- c. Extravehicular astronauts
- d. Prelaunch checkout facilities
- e. Space Tracking and Data Network (STDN)
- f. Tracking and Data Relay Satellite (TDRS)
- g. Space Ground Link System (SGLS)
- h. Orbiter vehicle landing site facilities
- i. Ground nav aids

## DISPLAYS AND CONTROLS

The Orbiter Displays and Controls (D&C) Subsystem consists of equipment and devices that allow the crew to supervise, control and monitor all of the Orbiter/Shuttle subsystems. It includes all of the Display and Control panels; manual controller; Cathode Ray Tube (CRT) displays; keyboards and associated electronics; display and controller encoding, decoding and conversion electronics; timing displays; Caution and Warning (C&W), and lighting provisions.

### Controls

Rotation Hand Controller (RHC) - Provides manual command capability in case the crew elects to not be in the automatic mode of the primary Flight Control Subsystem. It provides for roll and pitch control capability.

Rudder Pedal Transducer Assembly - Provides manual command capability for yaw control. Rudder displacement is displayed to the crew on the surface position indicator display.

Speedbrake Thrust Controller (SBTC) - Provides manual command capability for control of the Orbiter speedbrake surfaces. This unit consists of a single control handle mechanically linked to a set of triple redundant transducers. Outputs of the SBTC are interpreted as master thrust commands for the SSME's while the ET is attached to the Orbiter.

Keyboard - It is used to interface with the CRT display and manage the information displayed. In addition, it provides an entry means to send control commands to the computers for execution.

Translation Hand Controller - Provides a means of commanding acceleration along one or more of the Orbiter body axes using RCS control authority.

### Displays

Attitude Director Indicator (ADI) - Provides a simultaneous display of roll, pitch and yaw attitude angles, attitude error, and attitude angular rates. The ADI is used as a two-axis (roll and pitch) indicator for aerodynamic flight.

Surface Position Indicator (SPI) - Provides the position of the various aerodynamic control surfaces. Their positions are shown on moving pointer displays.

Alpha/Mach Indicator (AMI) - The AMI provides displays of the alpha (angle of attack), acceleration, mach number, and velocity equivalent airspeed in knots.

Altitude/Vertical Velocity Indicator (AVVI) - The AVVI provides a display of attitude acceleration, altitude rate, altitude, and radar altitude on a fixed scale with a moving pointer or on moving tapes behind a fixed lubber line.



Horizontal Situation Indicator (HSI) - Provides a display of vehicle in relationship with preselect navigation waypoints. Vehicle heading is displayed on the compass card. Bearing to the primary and secondary navigation points are displayed by bearing pointers and primary and secondary distance is displayed by the appropriate miles window.

Orbiter Display Unit - Provides a display, by means of a CRT, of the flight computers information in the form of a display page, i.e., alphanumeric and vector information. A display page is a predetermined format of static and/or dynamic data presented on the Display Unit and retrievable by crew action.

Computer Status Annunciator Assembly (CSA) - Provides display of the General Purpose Computer (GPC) fault status of each GPC as determined by itself and/or other members of the operating set of GPC's.

Fire Warning Annunciator Assembly (FWA) - Provides annunciation of smoke detection units that are located in the payload, cabin, left and right flight decks, and three forward avionics bays. Each sensor has its own display; the signal also actuates an emergency siren.

Caution and Warning Subsystem (C&W) - The C&W subsystem alerts the crew to malfunctions or out-of-limit conditions which may endanger the crew or Orbiter vehicle. The subsystem has a capacity of 120 input parameters and 40 lights. The subsystem also has an audible alarm, master reset switch, memory, inhibit switch and capability of changing the upper and lower limits of parameters in-flight.

#### INSTRUMENTATION SUBSYSTEM

The Instrumentation Subsystem consists of transducers, signal conditioning equipment, PCM encoding equipment, frequency multiplex equipment, PCM recorders, analog recorders, timing equipment, and on-board checkout equipment. The system is made up of two separate functional parts: Operational Instrumentation (OI) and Development Flight Instrumentation (DFI). The DFI will be used for development flights only and will be removed after the development phase of the program.

The OI is required to sense and acquire, condition, digitize, format and distribute data for display, telemetry, recording and checkout. The OI provides for PCM recording, voice recording, flight log recording (crash data) and master timing for on-board systems. During ground operations, the system processes and distributes ground originated commands to the on-board systems.

The DFI provides additional instrumentation similar to OI for development flights only. The DFI is required to sense and acquire, condition, digitize, format, frequency multiplex, distribute, and record data.

Major components in the Instrumentation Subsystem consist of the following:

Sensors - Low level sensors (10 to 100 MV output) will be used for temperatures, pressures, strains, etc.

Strain gauge pressure transducers will be used for pressure measurements. Piezoelectric transducers will be used for vibration, pressure and acoustic measurements in temperature environments of -425°F to +500°F. Resistance strain gauges will be used in measuring strains from cryogenic temperatures to 350°F.

Signal Conditioners - Signal conditioning, in general, will be accomplished in the forward or aft avionics bays and in DFI containers. The conditioners consist of charge amplifiers, active bridges, converters, etc.

PCM Equipment - is a stored program, non-destruct, read-only memory type. The equipment is capable of being programmed with several formats, selectable by external logic.

Recording Equipment - Consists of both analog and digital recorders. The digital recorders are used for storing OI or DFI PCM data and the analog recorders store voice information and frequency modulated data.

Master Timing Unit - Contains electronics equipment to provide both greenwich mean time and mission elapsed time. These signals are serial time coded to be used for time tagging OI and DFI data, displaying time to the crew, time reference for the on-board computers and the payloads.

Wideband Data Acquisition System - It is a frequency division multiplex system using frequency modulated subcarriers. Up to 150 wideband vibration, acceleration, acoustic, and pressure data channels can be accommodated on each flight. The output of the system is recorded on tape and some data is transmitted over a real time telemetry link.

#### DATA PROCESSING AND SOFTWARE

The data processing and software subsystem provides on-board data processing, data transfer, data entry, and display associated with operations of the Shuttle Orbiter avionics. The subsystem consists of the following:

- Major processing elements for computation and control, and interface links.
- Magnetic tape memories for large volume bulk storage and organizational information related to individual display presentations.
- Time-shared serial digital data buses to accommodate the data traffic between the computers and the other Orbiter subsystems.

- Remote interface units to convert and format data at the various interfacing subsystems.
- Remote interface units to command and status the Orbiter main rocket engines used in ascent.
- Display units to monitor and control the Orbiter and its mission by presentation, insertion, or change of selected variables.
- Computer programs for system management and subsystem operations per the Shuttle Orbiter mission phases.

The Data Processing System equipment items are as follows:

General Purpose Computer (GPC)  
 Mass Memory (MM)  
 Multiplexer/Demultiplexer (MDM)  
 Engine Interface Unit (EIU)  
 Multifunction Cathode Ray Tube (CRT)  
 Display System (MCDS)  
 Various Data Bus-Associated Equipment

The GPC's, MDM's and MM's are located in the forward avionics bay. MDM's and EIU's are located in the aft avionics bay; MDM's are also located in the flight deck and mid-ship.

#### ELECTRICAL POWER DISTRIBUTION & CONTROL (EPD&C)

The EPD&C Subsystem provides power distribution and power control for the entire Orbiter during all operational phases. The Subsystem interfaces with all other Orbiter subsystems that require operational and signal power and includes all electrical power and signal wiring and connections/terminations throughout the Orbiter.

The EPD&C Subsystem consists of major power distribution and control assemblies including wire harnesses for distribution of direct and alternating current to all using areas of the Orbiter. These assemblies are located in the forward, mid, and aft fuselages.

The Electrical Power Distribution and Control Subsystem consists of the following major assemblies:

Inverter  
 Inverter Distribution Control Assemblies  
 Main DC Distribution Assemblies  
 Forward DC Power Control Assemblies  
 Aft DC Power Control Assemblies  
 Mid DC Power Control Assemblies  
 Master Event Controllers (MEC)  
 Load Control Assemblies (LCA)  
 Motor Control Assemblies (MCA)  
 Proximity Switch Assemblies  
 Midbody Pyro Controller

ECLSS Power Supply and Charger  
H<sub>2</sub>-O<sub>2</sub> Cryo Heater Control Assemblies  
Backup Flight Control System Control Unit  
DFI Power Distribution Assemblies  
Wire Harnesses

The inverters, inverter distribution control, forward DC power control assemblies and ECSS power supply and charger are located in the forward fuselage avionics bays. The LCA's are located in both the forward and aft fuselage avionics bays. All of the other assemblies are located in either the forward and aft fuselage avionics bays and/or in the mid-fuselage section, except the MEC's are located in the aft avionics bays.

#### GENERAL PURPOSE COMPUTER (GPC)

In the OV-102, there are five GPC's comprising the Orbiter on-board computational complex. Four of the GPC's are synchronized, containing the identical primary program loads. The fifth GPC is dedicated to support of the back-up flight control system (BFS), a primary safety function.

Each GPC is a modified microprogram controlled central processing unit (CPU) with a unique input/output processor (IOP) interface to the serial data bus network. These two line replaceable units, the CPU and IOP, both contain portions of main memory which are used by either the CPU or the IOP on a non-dedicated basis. The CPU initiates all input/output actions through the execution of instructions to the IOP. These instructions and data words are transferred between the CPU and IOP on a bi-directional, parallel word data bus. Except for initiation, the IOP is independent of the CPU and executes its own programs, which reside in the common main memory. Read-only storage is used for controlling a fixed sequence of operations and internal data paths to be executed for each instruction.

#### PERFORMANCE MONITORING SUBSYSTEM (SYSTEM MANAGEMENT)

The Performance Monitoring Subsystem (PMS) provides two main functions, i.e., Automatic Fault Detection and Annunciation (FDA) and Subsystem Measurement Management (SMM). Other PMS functions associated with this subsystem include: (1) Subsystem Configuration Management, (2) Consumables Management, (3) Data Recording Management, (4) Telemetry Format Selection, (5) Payload Support, (6) Mission Profile Storage and Retrieval, (7) Performance Evaluation and Trend Analysis, and (8) Contingency Planning Aid.

The Automatic Fault Detection and Annunciation function is implemented entirely in software. The purpose of the function is to detect subsystem failures at the functional path level (level at which corrective action can be taken in flight) and inform the crew that the failure has occurred. Failure alarm warnings to the crew consist of: (1) a back-up Caution & Warning (C&W) Master Alarm signal that is generated whenever the failed parameter is a member of the C&W

Parameter Group, and (2) a System Management (SM) Crew Alert Alarm utilizing a small blue light and a short duration tone whenever any parameter is declared failed. These SM parameters are to be distinguished from C&W in that SM parameters are not safety-critical. The SM, however, does provide a back-up capability for the hardwired C&W subsystem to alert the crew to any detected hazardous or potentially hazardous conditions which requires attention. Back-up C&W limits are identical to primary C&W limits.

The Subsystem Measurement Management function is implemented entirely in software. The purpose of the function is to provide the crew with access to measurement data from which the degree of a problem can be assessed. This information is not forced on the CRT but must be called up on the CRT by the crew taking appropriate keyboard action.

## SAFETY FEATURES

### GENERAL

The avionics system safety features are a fallout of the program redundancy - of-function requirements. A primary and one or more alternate methods of accomplishing the avionics functions, or their mission alternates without risk to the crew on the orbiter are provided. General avionics hazards concern the following hazard groups:

- . Fire/Explosion
- . Loss of Flight Control
- . Equipment Failure/Damage

### Fire/Explosion

Accommodation of fire/explosion hazards is done by assessing all avionics equipment specifications to ensure that equipment to be installed in fire/explosion susceptible zones are designed to eliminate ignition sources of overt arcing/sparking or elevated LRU external case temperature. Location and severity criteria are presented in SD74-0223B. OV-102 installed avionics LRU specifications have been reviewed to ensure that avionics equipment installed external to the cabin and in a fire/explosion susceptible environment are explosion proofed or have been analyzed to ensure that LRU temperatures do not exceed minimum specified threshold values.

### Loss of Flight Control

Hazards of this nature, as applied generally to all avionics equipment concern:

- . Control signal loss
- . Relay malfunction
- . Power interruptions
- . Power transients

A backup flight control system has been incorporated in the OV-102 to accommodate software drop out in the primary system. Additionally, the primary control system has a down moding capability wherein pilot inputs can override - loss of guidance sensor data in many mission phase segments.

Relay safety concerns primarily address the situation wherein relays designed to operate in a launch boost environment fail to operate under vehicle coast (quiescent conditions). The fail operational/fail safe criterion as applied to the relays, as well as the stringent vibration/non-vibration relay test environment provides a reasonable degree of confidence that the risk has been minimized.

Power interruptions have been analyzed and the electrical power distribution and control emphasizes the application of multiple bus segment ties to ensure that two failures in any bus system will not remove critical equipment from the line.

Power transients are treated by incorporating conservative power frequency/amplitude windows in all the avionics equipment specifications and requiring test verification under varying environmental and electrical conditions.

### Equipment Failure/Damage

The reliability program implemented on the Shuttle Orbiter addresses failure modes and their effects. This analyzes high failure/damage critical equipment which is then separately assessed for safety hazards. Additionally "lessons learned" documents, such as MSC 00134, "Space Flight Hazards Catalog" provide checklists to ensure coverage for equipment failure/damage hazard assessment.

### GUIDANCE - NAVIGATION & CONTROL

Safety concerns in the OV-102 OFT phase are alleviated in that the IMU selection criteria has been reinstated to ensure selection of the better remaining IMU (FO/FS), and air data uncertainties are being accommodated by: 1) extending availability of NAV derived data to the ground, 2) placarding initial flights to low or no wind conditions, 3) allowing altitude update acceptance by the software, and desensitizing the GN&C application programs - for example, navigation locks out the baro altimeter input in the transonic region.

### COMMUNICATION & TRACKING

The most apparent communication and tracking subsystem safety feature is that of redundancy of equipments per function, and redundancy of function. The specific hazard of corona and arcing is addressed in the design phase by requiring compliance with requirement 45 of MIL-STD-454 as called out in paragraph 3.4.3 of MF-0004-002B.

### DISPLAYS & CONTROLS

Special emphasis has been placed on a safety analysis and review of the design and parameter selection in the Caution and Warning (C&W) Subsystem. One of the criteria that was used in the selection of C&W parameters has been the requirement that the measurement must be safety-critical, i.e., it involves crew and/or vehicle safety. In addition, all C&W parameters require timely crew attention. The C&W subsystem has capacity for 40 lights and 120 input signals. C&W false alarms, which have occurred in other space missions, are not likely because of a transient filter design feature. In addition, the crew has the capability of changing the parameter limits or inhibiting specific parameters during the mission. Redundancy requirements for the C&W are satisfied by having a primary hardwired subsystem which is backed-up by a separate software signal from the Systems Management (SM) computer function.

The only area of C&W where there is not complete redundancy is in the transducers. There are single transducers which output to both the hard-wired C&W and also the back-up SM C&W. HA 1ZXX-0503-03 discusses this issue and points out that it is only used in FO/FS system applications. C&W power supply issues are discussed in 1ZXX-0503-10 and it is noted that redundant power is available in the C&W Electronics Unit and a "C&W Fail" annunciator is present to alert the crew to C&W malfunctions.

Several reviews have been conducted to ensure that switch guards are designed for controls that have safety-critical functions. The two most positive switch guards that are used are the lever lock toggle switches and the cover guard over push button switches. The switch guard issue is considered to be a controlled area although re-appraisals of the design will be made incrementally.

The Back-up Flight Control System (BFCS) has been added to the OV-102 vehicle design. The BFCS engage switch has been incorporated on the rotation hand controller. The BFCS adds significant flexibility in terms of crew/vehicle safety for the OT program; this is especially true in light of undetected generic software errors in the GN&C primary system.

Abort detection, verification, and initiation is a crew initiated function. There is an abort display but that is only an "Abort Request" when a ground station detects an abort situation and recommends an abort to the orbiter crew. The actual selection of the particular abort mode, i.e., RTLS, AOA, ATO, is performed with the abort Rotary switch on the flight panel. The initiation of the abort sequence occurs when a push button switch, below the selector switch, is depressed. This abort initiation switch has a cover guard over it.

Under nominal conditions, the abort trajectory is flown in an automatic flight control mode. The flight crew's primary function will be to monitor the performance of the automatic initiated events and sequences via dedicated displays and the CRT. The crew has the capability of intervening and overriding automatic functions if malfunctions are detected.

## INSTRUMENTATION

There are no open HA's associated with the Instrumentation Subsystem. Due to the degree of redundancy in this subsystem and the fact that the primary functions of this subsystem are data recording and telemetry, which are not safety-critical, failures or faults which have been identified do not pass the ground rule screening tests for HA's. However, this subsystem will continue to be assessed and if hazards are identified which are compatible with the existing HA ground rules, they will be identified in the next update.



## DATA PROCESSING & SOFTWARE

The data processing system handles safety concerns by requiring multiple computers, data buses and a complete back-up computational system where critical "orbiter-get-home-and-land" functions dictate. The Advanced Development Laboratory and the Shuttle Avionics Integration Laboratory are dedicated to marrying the software to the orbiter hardware and the orbiter software function to the Shuttle mission operations. Software developed separately for the primary and back-up flight control systems provides a redundancy for critical flight software function.

## REDUNDANCY MANAGEMENT

Redundancy Management (RM) is used in the GN&C subsystem. By monitoring signals using available sensory circuitry and, where required, RM dedicated software, RM controls the GN&C selection filter function. Down mode inhibit of the GN&C removes RM by inhibiting its filter selection function control, although RM continues its monitoring function. With the RM inhibited, the mid value select filter accomplishes the voting function allowing the extremes of signal excursions to be by-passed in favor of the median signals.

## ELECTRICAL POWER DISTRIBUTION & CONTROL

Hazards associated with this system are concerned with loss of power and/or control and the ability of the removable equipments, as well as permanent electrical installation to survive failure and/or damage. The design philosophy of fail operational/fail safe expressly accommodates the loss of power and/or control hazards. The hazards of failure and/or damage are each accounted for and, where still "IN WORK," have resolutions based on inclusion of safety warnings, cautions and notes in the appropriate OV-102 Flight Data File documents.

## COMPUTER COMPLEX

The safety concerns of the single computer complex are addressed by providing a separate computer, other than the 4GPC redundant set, in critical areas to ensure an "orbiter-get-home-and-land" capability.

## PERFORMANCE MONITORING SUBSYSTEM (SYSTEM MANAGEMENT)

It is to be noted that the basic functions of the PMS are not safety-critical in that these functions do not directly involve orbiter vehicle or crew safety. The only exception to this statement is that the PMS performs a back-up function for the hardwired C&W system, in that all C&W parameters are monitored by PMS and will be annunciated on the C&W by the back-up C&W light and master alarm.

## AVIONICS SYSTEM HAZARD SUMMARY

This volume of the Safety Analysis Report addresses the OV-102 Shuttle Orbiter, Vertical Flight Configuration, Avionics System. Seventy-two HA's have been identified in the Avionics area. The hazard analysis was performed in parallel with design definition and many of these hazards were identified from information in reports such as the Accident/Incident Data Bank and the JSC 00134 Space Flight Hazard Catalog that was available from previous programs. In most cases the initial design incorporated the safety features to eliminate or control these hazards, and the Safety Analysis Report listing was used as a method to check that the safety features were incorporated in the design. Table I is a summary of the number of hazards in each hazard category for each Avionics group. Table II lists each of the hazards identified by Avionics subsystem, and their disposition. Table III is a mission phase breakdown of the HA's. Of the seventy-two hazards identified, sixty-three of these are closed and nine are open, eight of which are in an in-work status and one is a residual hazard.

### Residual

1YXX-0501-09, "Redundant Paths not Adequately Separated - IMU's Collocated," - addresses the issue wherein the IMU's, for purposes of accuracy and alignment integrity, are located on a common nav base. The risk associated with this design decision - that of a single gross impact and/or collision putting all IMU's out of business - is weighed against the fact that the crew and IMU's share a similar risk environment. The operational need for collocation appears to overrule the exposure to risk exhibited by collocation.

### In-Work

1YXX-0501-04, "False Lock-On/Unlock of Star Tracker Optics," with the SAIL verification of stellar position vs. IMU position, periodic drift/rate and magnitude check software and incorporation of initial star ID procedures in the Flight Data File, this hazard will be closed.

1YXX-0501-13, "Failure to Initiate Post ET Separation Orbiter Pitch-Up During RTLS Abort," has been reopened as initial Backup Flight System specifications, MG038100-series, do not provide as yet back-up software in the RTLS abort phase to support a primary system software generic fault. These specifications have not been baselined.

1ZXX-0501-15, "Premature Nose Pitch Down at Roundout - Autoland Function Only." This hazard concerns an erroneous sequence gate entered into the FCS by a failed "Weight-on-Wheels" circuit making the vehicle believe it is on the ground while still airborne. The problem is being handled on the OV-101 through a procedural accommodation. On OV-102, the basic design is being assessed and the design approved to minimize exposure to risk has not been baselined at this time.

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1YXX-0502-03, "Leakage of MSBLS KU-Band Wave Circle Through Pressure Bulkhead Reduces Cabin Pressure," this hazard will remain open until successful completion of the vibration and pressure check and qualification tests per AVCO QTP No. 004, Rev. 3, provide assurance of waveguide pressure integrity.

1YXX-0506-04, "Inadvertent Pyro Firing Misfiring," inhibition is sensitive to the procedures in the Flight Data File. This hazard will remain open until procedures have been prepared to accommodate the above potential hazard.

1ZXX-0506-08, "Off Schedule 'Arming' or 'Disarming' of Systems," this hazard will remain open until procedures have been prepared to accommodate all "Arm" and "Disarm" conditions in the ALT phase and, later on in the OFT phase.

1ZXX-0506-10, "Failure to Deadface KU-Band Radar Boom Power Circuits Before Guillotining/Jettisoning," this hazard will be closed when the appropriate procedure to, "---- remove power before jettisoning KU-Band Radar Boom" is inserted in the Flight Data File.

1ZXX-0506-14, "Powering up Systems with Latching Relays in Unknown Positions," this hazard closure is sensitive to the procedures that will identify and accommodate the positioning of latching relays prior to powering up the systems. This study is in process.

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# HAZARD GROUP APPLICATION MATRIX

## Avionics Subsystems

| HAZARD GROUP                | CODE | AVIONICS-<br>GENERAL | GN&C | C&T | D&C | INST. | DATA PROC.<br>& SOFT. | EPDC | COMP. | PMF |
|-----------------------------|------|----------------------|------|-----|-----|-------|-----------------------|------|-------|-----|
| LOSS OF PERSONNEL           | AA   | N/A                  | N/A  | N/A | N/A | N/A   | N/A                   | N/A  | N/A   | N/A |
| COLLISION/IMPACT            | BB   | N/A                  | N/A  | N/A | 1   | N/A   | N/A                   | N/A  | N/A   | N/A |
| FIRE/EXPLOSION<br>IMPLOSION | CC   | 1                    | N/A  | 2   | 1   | N/A   | 1                     | N/A  | N/A   | N/A |
| LOSS OF/UNSAFE ENV.         | DD   | N/A                  | N/A  | 1   | 8   | N/A   | N/A                   | N/A  | N/A   | N/A |
| CRASH LANDING               | EE   | N/A                  | N/A  | N/A | N/A | N/A   | N/A                   | N/A  | N/A   | N/A |
| LOSS OF FLIG. CONT.         | FF   | 4                    | 13   | N/A | 10  | N/A   | 2                     | 11   | 4     | N/A |
| EQUIPMENT FAIL./<br>DAMAGE  | XX   | 3                    | N/A  | N/A | N/A | N/A   | N/A                   | 10   | N/A   | N/A |

N/A - Not Applicable

TABLE I

TABLE II  
HAZARD ANALYSIS SUMMARY

| MODEL                          |              |  | SHUTTLE ORBITER OV-102 CDR |          |            |            |          | STATUS |        |  |   |  |
|--------------------------------|--------------|--|----------------------------|----------|------------|------------|----------|--------|--------|--|---|--|
| SUBSYSTEM GROUP                |              |  | AVIONICS                   |          |            |            |          | OPEN   | CLOSED |  |   |  |
| HAZARD NUMBER                  | HAZARD GROUP | PROBLEM DESCRIPTION                                | IN-WORK                    | RESIDUAL | ELIMINATED | CONTROLLED | ACCIDENT |        |        |  |   |  |
| <u>GENERAL</u>                 |              |  |                            |          |            |            |          |        |        |  |   |  |
| 1ZXX-0500-01                   | XX           | Failure to Key Connectors                          |                            |          |            |            |          |        |        |  | X |  |
| 1ZXX-0500-02                   | XX           | Use of Counterfeit Parts                           |                            |          |            |            |          |        |        |  | X |  |
| 1ZXX-0500-03                   | XX           | Use of Wet Tantalum Capacitors                     |                            |          |            |            |          |        |        |  | X |  |
| 1ZXX-0500-04                   | FF           | Momentary Power Interrupt                          |                            |          |            |            |          |        |        |  | X |  |
| 1ZXX-0500-05                   | FF           | Transient Power Supply                             |                            |          |            |            |          |        |        |  | X |  |
| 1ZXX-0500-06                   | CC           | Spurious Ignition Sources                          |                            |          |            |            |          |        |        |  | X |  |
| 1ZXX-0500-08                   | FF           | Failure of Relays                                  |                            |          |            |            |          |        |        |  | X |  |
| 1YXX-0500-09                   | FF           | Premature/False Initiation of ET Separation Access |                            |          |            |            |          |        |        |  | X |  |
| <u>GN&amp;C</u>                |              |  |                            |          |            |            |          |        |        |  |   |  |
| 1ZXX-0501-02                   | FF           | Loss of IMU Platform Stability                     |                            |          |            |            |          |        |        |  | X |  |
| 1YXX-0501-04                   | FF           | False Lock-On/Unlock of Star Tracker               |                            | X        |            |            |          |        |        |  |   |  |
| 1ZXX-0501-06                   | FF           | Inability to Access TAEMS                          |                            |          |            |            |          |        |        |  | X |  |
| 1ZXX-0501-07                   | FF           | Loss of Rate Gyro Stability                        |                            |          |            |            |          |        |        |  | X |  |
| 1YXX-0501-08                   | FF           | Loss of Guidance System Accuracy                   |                            |          |            |            |          |        |        |  | X |  |
| 1YXX-0501-09                   | FF           | Redundant IMU's Collocated                         |                            |          | X          |            |          |        |        |  |   |  |
| 1YXX-0501-11                   | FF           | Improper Air Data/Loss of Air Data                 |                            |          |            |            |          |        |        |  | X |  |
| 1YXX-0501-12                   | FF           | Exceeding Limit Load Factors/Entry                 |                            |          |            |            |          |        |        |  | X |  |
| 1YXX-0501-13                   | FF           | Failure to Initiate Post ET Pitch-Up               |                            | X        |            |            |          |        |        |  |   |  |
| 1ZXX-0501-15                   | FF           | Premature Nose Pitch Down at Round-Out             |                            | X        |            |            |          |        |        |  |   |  |
| 1YXX-0501-50                   | FF           | False Initiation of SSME Auto Shut-Down            |                            |          |            |            |          |        |        |  | X |  |
| 1YXX-0501-54                   | FF           | Failure to Obtain FCS End-To-End Check             |                            |          |            |            |          |        |        |  | X |  |
| 1ZXX-0501-57                   | FF           | Failure to Disable MDM Body Flap                   |                            |          |            |            |          |        |        |  | X |  |
| <u>C&amp;T</u>                 |              |  |                            |          |            |            |          |        |        |  |   |  |
| 1ZXX-0502-02                   | CC           | Corona and Arcing                                  |                            |          |            |            |          |        |        |  | X |  |
| 1YXX-0502-02-01                | CC           | Failure of Wave Guide in RCS Bay                   |                            |          |            |            |          |        |        |  | X |  |
| 1YXX-0502-03                   | DD           | MSBLS Ku-Band Wave Guide Leakage                   |                            | X        |            |            |          |        |        |  |   |  |
| <u>DISPLAYS &amp; CONTROLS</u> |              |  |                            |          |            |            |          |        |        |  |   |  |
| 1ZXX-0503-02                   | CC           | False Fire Alarm                                   |                            |          |            |            |          |        |        |  | X |  |
| 1ZXX-0503-03                   | DD           | Failure of C&W to Alert Crew                       |                            |          |            |            |          |        |        |  | X |  |
| 1ZXX-0503-04                   | FF           | Accidental Actuation of Switch                     |                            |          |            |            |          |        |        |  | X |  |
| 1ZXX-0503-05                   | FF           | Insufficient C&W for BFCS Engage                   |                            |          |            |            |          |        |        |  | X |  |
| 1ZXX-0503-07                   | DD           | False Alarm from C&W                               |                            |          |            |            |          |        |        |  | X |  |
| 1ZXX-0503-09                   | DD           | Delay in Back-up C&W                               |                            |          |            |            |          |        |        |  | X |  |
| 1ZXX-0503-10                   | DD           | Bus Failure for C&W                                |                            |          |            |            |          |        |        |  | X |  |
| 1ZXX-0503-11                   | FF           | Insufficient Time to Engage BFCS                   |                            |          |            |            |          |        |        |  | X |  |
| 1ZXX-0503-12                   | FF           | Fail to Engage BFCS and Downmodes                  |                            |          |            |            |          |        |        |  | X |  |

(continued)

TABLE II  
HAZARD ANALYSIS SUMMARY

| MODEL SHUTTLE ORBITER OV-102 CDR       |              |  | STATUS  |          |            |            |          |
|--|--------------|--|---------|----------|------------|------------|----------|
| SUBSYSTEM GROUP AVIONICS               |              |  | OPEN    | CLOSED   |            |            |          |
| HAZARD NUMBER                          | HAZARD GROUP | PROBLEM DESCRIPTION  | IN-WORK | RESIDUAL | ELIMINATED | CONTROLLED | ACCEPTED |
| <u>DISPLAYS &amp; CONTROLS</u> (Cont.) |              |  |         |          |            |            |          |
| 1ZXX-0503-13                           | FF           | Failure in RHC   |         |          |            | X          |          |
| 1YXX-0503-14                           | DD           | Erroneous Alarm  |         |          |            | X          |          |
| 1YXX-0503-15                           | DD           | Failure of Alarm   |         |          |            | X          |          |
| 1YXX-0503-16                           | DD           | Ground Unable to Alert Crew                                  |         |          |            | X          |          |
| 1YXX-0503-17                           | BB           | Orbiter/Payload Collision - RHC Failure                      |         |          |            | X          |          |
| 1YXX-0503-18                           | FF           | Failure to Annunciate OME Out                                |         |          |            | X          |          |
| 1YXX-0503-19                           | FF           | Abort Light Illumination Cause Not Easily Discernible        |         |          |            | X          |          |
| 1YXX-0503-20                           | FF           | High "g" Loading May Prevent Control Actuation               |         |          |            | X          |          |
| 1YXX-0503-21                           | FF           | Erroneous Abort Signal                                       |         |          |            | X          |          |
| 1YXX-0503-22                           | FF           | OME Out Lite May Prematurely Indicate Need to Abort          |         |          |            | X          |          |
| 1YXX-0503-23                           | DD           | CO2 Level Not Annunciated                                    |         |          |            | X          |          |
| <u>DATA PROC. &amp; SOFTWARE</u>       |              |  |         |          |            |            |          |
| 1YXX-0505-02                           | FF           | Single Fault in GPC  |         |          |            | X          |          |
| 1ZXX-0505-03                           | FF           | Overloading of Spacecraft GPC                                |         |          |            | X          |          |
| 1ZXX-0505-04                           | CC           | Data Bus Coupler Ignition Source                             |         |          |            | X          |          |
| <u>EPD&amp;C</u>                       |              |  |         |          |            |            |          |
| 1YXX-0506-03                           | FF           | Misfire of NLG Deploy Pyro                                   |         |          |            | X          |          |
| 1YXX-0506-04                           | FF           | Inadvertent Pyro Firing/Misfiring                            | X       |          |            |            |          |
| 1ZXX-0506-05                           | FF           | Inability to Close Speed Brake Elect. Control                |         |          |            | X          |          |
| 1ZXX-0506-06                           | FF           | Lack of Redundant Relays                                     |         |          |            | X          |          |
| 1ZXX-0506-07                           | XX           | Inadequate Locking of Connectors                             |         |          |            | X          |          |
| 1ZXX-0506-08                           | FF           | Off Schedule Arm/Disarm of Systems                           | X       |          |            |            |          |
| 1ZXX-0506-09                           | XX           | Failure to Protect Power Supply                              |         |          |            | X          |          |
| 1ZXX-0506-10                           | XX           | Failure to Deadface Guillotine Circuits                      | X       |          |            |            |          |
| 1ZXX-0506-11                           | XX           | Mating/Demating With Power                                   |         |          |            | X          |          |
| 1ZXX-0506-12                           | FF           | ET Door Powering Inverter Failure/RTLS                       |         |          |            | X          |          |
| 1ZXX-0506-13                           | XX           | Circuit Breakers Slow Acting                                 |         |          |            | X          |          |
| 1ZXX-0506-14                           | XX           | Unknown Relay State in Start-Up                              | X       |          |            |            |          |
| 1ZXX-0506-15                           | XX           | Damage Susceptibility of Wiring Harness                      |         |          |            | X          |          |
| 1ZXX-0506-16                           | XX           | Failure to Release LH <sub>2</sub> /O <sub>2</sub> Umbilical |         |          |            | X          |          |
| 1ZXX-0506-17                           | FF           | Remotely Actuated Doors - Power Control Loss                 |         |          |            | X          |          |
| 1ZXX-0506-18                           | FF           | Brakes Fail to Actuate                                       |         |          |            | X          |          |
| 1ZXX-0506-19                           | XX           | Nose Gear Steering System Loss of Control                    |         |          |            | X          |          |
| (continued)                            |              |  |         |          |            |            |          |

TABLE II  
HAZARD ANALYSIS SUMMARY

| MODEL           |              | SHUTTLE ORBITER OV-102                       |  |  | STATUS  |          |            |            |          |
|-----------------|--------------|--|--|--|---------|----------|------------|------------|----------|
| SUBSYSTEM GROUP |              | AVIONICS                                     |  |  | OPEN    | CLOSED   |            |            |          |
| HAZARD NUMBER   | HAZARD GROUP | PROBLEM DESCRIPTION                          |  |  | IN-WORK | RESIDUAL | ELIMINATED | CONTROLLED | ACCEPTED |
| EPD&C (Cont.)   |              |  |  |  |         |          |            |            |          |
| 1ZXX-0506-20    | XX           | Payload Deploy/Retrieve - Power/Control Loss |  |  |         |          |            | X          |          |
| 1ZXX-0506-21    | FF           | Loss of Power to Rudder                      |  |  |         |          |            | X          |          |
| 1ZXX-0506-22    | FF           | Loss of Power to Body Flap                   |  |  |         |          |            | X          |          |
| 1ZXX-0506-23    | FF           | Payload Retention - Power/Control Loss       |  |  |         |          |            | X          |          |
| COMPUTERS       |              |  |  |  |         |          |            |            |          |
| 1ZXX-0507-01    | FF           | Power Interrupt Causes Computer Shutdown     |  |  |         |          |            | X          |          |
| 1ZXX-0507-03    | FF           | Manual Override Lock Out                     |  |  |         |          |            | X          |          |
| 1YXX-0507-04    | CC           | RCS Commands When Stowed                     |  |  |         |          | X          |            |          |
| 1ZXX-0507-06    | FF           | Use of "Loc-Tite" With Magnetic Tape         |  |  |         |          |            | X          |          |

TABLE III

## HAZARD ANALYSIS MISSION PHASE LISTING

SUBSYSTEM GROUP: AVIONICS

| HAZARD NUMBER             | PROBLEM DESCRIPTION                      |
|---------------------------|--|
| <u>PRELAUNCH</u>          |  |
| 1ZXX-0500-01              | Failure to Key Connectors                |
| 1ZXX-0500-02              | Use of Counterfeit Parts                 |
| 1ZXX-0500-03              | Use of Wet Tantalum Capacitors           |
| 1ZXX-0500-04              | Momentary Power Interrupt                |
| 1ZXX-0500-05              | Transient Power Supply                   |
| 1ZXX-0500-06              | Spurious Ignition Sources                |
| 1ZXX-0500-08              | Failure of Relays                        |
| 1YXX-0500-09              | Premature/False Initiation of ET SEP.    |
| 1YXX-0501-54              | Failure to Obtain FCS Check              |
| 1ZXX-0502-02              | Corona and Arcing                        |
| 1ZXX-0503-02              | False Fire Alarm                         |
| 1ZXX-0503-03              | Failure of C&W to Alert                  |
| 1ZXX-0503-07              | False Alarm From C&W                     |
| 1ZXX-0503-09              | Delay in Back-up C&W                     |
| 1ZXX-0503-10              | Bus Failure for C&W                      |
| 1YXX-0503-02              | Single Fault in GPC                      |
| 1ZXX-0505-03              | GPC Overload                             |
| 1ZXX-0505-04              | Data Bus Coupler Ignition Source         |
| 1YXX-0506-04              | Inadvertent Pyro Firing/Misfiring        |
| 1ZXX-0506-06              | Lack of Redundant Relays                 |
| 1ZXX-0506-07              | Inadequate Locking of Connectors         |
| 1ZXX-0506-08              | Off Schedule Arming/Disarming of Systems |
| 1ZXX-0506-09              | Failure to Protect Power Supply          |
| 1ZXX-0506-10              | Failure to Deadface Guillotined Circuits |
| 1ZXX-0506-11              | Mating/Demating With Power               |
| 1ZXX-0506-13              | Circuit Breakers Slow Acting             |
| 1ZXX-0506-14              | Unknown Relay State in Start-Up          |
| 1ZXX-0506-15              | Demate Susceptibility to Wiring Harness  |
| 1YXX-0506-23              | Loss of Power to Payload Retention       |
| 1YXX-0507-04              | RCS Commands When Stowed                 |
| 1ZXX-0507-06              | Use of "Loc-Tite" With Magnetic Tap      |
| <u>LIFTOFF THRU ORBIT</u> |  |
| 1ZXX-0500-01              | Failure to Key Connectors                |
| 1ZXX-0500-02              | Use of Counterfeit Parts                 |
| 1ZXX-0500-03              | Use of Wet Tantalum Capacitors           |
| 1ZXX-0500-04              | Momentary Power Interrupt                |
| 1ZXX-0500-05              | Transient Power Supply                   |
| 1ZXX-0500-06              | Spurious Ignition Sources                |

(continued)



TABLE III

## HAZARD ANALYSIS MISSION PHASE LISTING

SUBSYSTEM GROUP: AVIONICS

| HAZARD NUMBER                     | PROBLEM DESCRIPTION                      |
|-----------------------------------|--|
| <u>LIFTOFF THRU ORBIT (Cont.)</u> |  |
| 1ZXX-0500-08                      | Failure of Relays                        |
| 1YXX-0500-09                      | Premature/False Initiation of ET Sep.    |
| 1ZXX-0501-02                      | Loss of IMU Platform Stability           |
| 1ZXX-0501-07                      | Loss of Rate Gyro Stability              |
| 1YXX-0501-08                      | Loss of Guidance System Accuracy         |
| 1YXX-0501-09                      | Redundant IMU's Collocated               |
| 1YXX-0501-13                      | Failure to Initiate Post ET Pitch-up     |
| 1YXX-0501-50                      | False Initiation of SSME Auto Shutdown   |
| 1YXX-0501-54                      | Failure to Obtain FCS Check              |
| 1ZXX-0502-02                      | Corona and Arcing                        |
| 1ZXX-0503-02                      | False Fire Alarm                         |
| 1ZXX-0503-03                      | Failure of C&W to Alert                  |
| 1ZXX-0503-04                      | Accidental Actuation of Switch           |
| 1ZXX-0503-05                      | Insufficient C&W for BFCS Engage         |
| 1ZXX-0503-07                      | False Alarm From C&W                     |
| 1ZXX-0503-09                      | Delay in Back-up C&W                     |
| 1ZXX-0503-10                      | Bus Failure for C&W                      |
| 1ZXX-0503-11                      | Insufficient Time to Engage BFCS         |
| 1ZXX-0503-12                      | Fails to Engage BFCS and Downmodes       |
| 1ZXX-0503-13                      | Failure in RHC                           |
| 1YXX-0503-14                      | False Rapid Depress Alarm                |
| 1YXX-0503-15                      | Rapid Depress Alarm Fails                |
| 1YXX-0503-18                      | OMS Alarm for Abort                      |
| 1YXX-0503-19                      | Lack of Abort Verification               |
| 1YXX-0503-20                      | "G" Forces in Abort Situation            |
| 1YXX-0503-21                      | Erroneous Abort Light                    |
| 1YXX-0503-22                      | OMS Engine Out Causes Abort              |
| 1YXX-0503-23                      | No Alarm for CO <sub>2</sub> Build-up    |
| 1ZXX-0505-03                      | GPC Overload                             |
| 1ZXX-0505-04                      | Data Bus Coupler Ignition Source         |
| 1YXX-0506-03                      | Misfire of NLG Pyro                      |
| 1YXX-0506-04                      | Inadvertent Pyro Firing/Misfiring        |
| 1ZXX-0506-06                      | Lack of Redundant Relays                 |
| 1ZXX-0506-07                      | Inadequate Locking of Connectors         |
| 1ZXX-0506-08                      | Off Schedule Arming/Disarming of Systems |
| 1ZXX-0506-09                      | Failure to Protect Power Supply          |
| 1ZXX-0506-10                      | Failure to Deadface Guillotined Circuits |
| 1YXX-0506-12                      | ET Door Powering Inverter Failure        |
| 1ZXX-0506-13                      | Circuit Breathers Slow Acting            |

(continued)

TABLE III

## HAZARD ANALYSIS MISSION PHASE LISTING

SUBSYSTEM GROUP: AVIONICS

| HAZARD NUMBER                     | PROBLEM DESCRIPTION  |
|-----------------------------------|--|
| <u>LIFTOFF THRU ORBIT (Cont.)</u> |  |
| 1ZXX-0506-15                      | Damage Susceptibility to Wiring Harness                      |
| 1YXX-0506-16                      | Failure to Release LH <sub>2</sub> /O <sub>2</sub> Umbilical |
| 1YXX-0506-17                      | Remotely Actuated Doors - Power Loss                         |
| 1ZXX-0506-21                      | Loss of Power to Rudder                                      |
| 1ZXX-0506-22                      | Loss of Power to Body Flap                                   |
| 1YXX-0506-23                      | Loss of Power to Payload Retention                           |
| 1ZXX-0507-01                      | Power Interrupt Causes Shutdown                              |
| 1ZXX-0507-03                      | Manual Override Lockout                                      |
| 1YXX-0507-04                      | RCS Commands When Stowed                                     |
| 1ZXX-0507-06                      | Use of "Loc-Tite" with Magnetic Tape                         |
| <u>ON-ORBIT</u>                   |  |
| 1ZXX-0500-01                      | Failure of Key Connectors                                    |
| 1ZXX-0500-02                      | Use of Counterfeit Parts                                     |
| 1ZXX-0500-03                      | Use of Wet Tantalum Capacitors                               |
| 1ZXX-0500-04                      | Momentary Power Interrupt                                    |
| 1ZXX-0500-05                      | Transient Power Supply                                       |
| 1ZXX-0500-06                      | Spurious Ignition Sources                                    |
| 1ZXX-0500-08                      | Failure of Relays  |
| 1ZXX-0501-02                      | Loss of IMU Platform Stability                               |
| 1YXX-0501-04                      | False Lock-On/Unlock of Star Tracker                         |
| 1ZXX-0501-07                      | Loss of Rate Gyro Stability                                  |
| 1YXX-0501-08                      | Loss of Guidance System Accuracy                             |
| 1YXX-0501-09                      | Redundant IMU's Collocated                                   |
| 1ZXX-0502-02                      | Corona and Arcing  |
| 1YXX-0502-02-01                   | Failure of Waveguide in RCS Bay                              |
| 1YXX-0502-03                      | MSBLS KU-Band Waveguide Leakage                              |
| 1ZXX-0503-02                      | False Fire Alarm   |
| 1ZXX-0503-03                      | Failure of C&W to Alert                                      |
| 1ZXX-0503-07                      | False Alarm From C&W   |
| 1ZXX-0503-09                      | Delay in Back-up C&W   |
| 1ZXX-0503-10                      | Bus Failure for C&W  |
| 1YXX-0503-14                      | False Rapid Depress Alarm                                    |
| 1YXX-0503-15                      | Rapid Depress Alarm Fails                                    |
| 1YXX-0503-16                      | Ground Station Uplink Alarm                                  |
| 1YXX-0503-17                      | Payload Collision With Orbiter                               |
| 1YXX-0503-23                      | No Alarm for CO <sub>2</sub> Build-up                        |
| 1ZXX-0505-03                      | GPC Overload   |
| 1ZXX-0505-04                      | Data Bus Coupler Ignition Source                             |
| 1YXX-0506-03                      | Misfire of NLG Pyro  |
| 1YXX-0506-04                      | Inadvertent Pyro Firing/Misfiring                            |
| 1ZXX-0506-06                      | Lack of Redundant Relays                                     |
| 1ZXX-0506-07                      | Inadequate Locking of Connectors                             |
| 1ZXX-0506-08                      | Off Schedule Arming/Disarming of Systems                     |
| 1ZXX-0506-09                      | Failure to Protect Power Supply                              |

(continued)

SD77-SH-0001-06

TABLE III

## HAZARD ANALYSIS MISSION PHASE LISTING

SUBSYSTEM GROUP: AVIONICS

| HAZARD NUMBER               | PROBLEM DESCRIPTION                      |
|-----------------------------|--|
| <u>ON ORBIT (Cont.)</u>     |  |
| 1ZXX-0506-10                | Failure to Deadface Guillotined Circuits |
| 1ZXX-0506-13                | Circuit Breakers Slow Acting             |
| 1ZXX-0506-15                | Damage Susceptibility to Wiring Harness  |
| 1YXX-0506-20                | Payload Deploy/Retrieve Control Loss     |
| 1YXX-0506-23                | Loss of Power to Payload Retention       |
| 1YXX-0507-04                | RCS Commands When Stowed                 |
| 1ZXX-0507-06                | Use of "Loc-Tite" With Magnetic Tape     |
| <u>DEORBIT THRU LANDING</u> |  |
| 1ZXX-0500-01                | Failure to Key Connectors                |
| 1ZXX-0500-02                | Use of Counterfeit Parts                 |
| 1ZXX-0500-03                | Use of Wet Tantalum Capacitors           |
| 1ZXX-0500-04                | Momentary Power Interrupt                |
| 1ZXX-0500-05                | Transient Power Supply                   |
| 1ZXX-0500-06                | Spurious Ignition Sources                |
| 1ZXX-0501-02                | Loss of IMU Platform Stability           |
| 1YXX-0501-06                | Inability to Access TAEMS                |
| 1ZXX-0501-07                | Loss of Rate Gyro Stability              |
| 1YXX-0501-08                | Loss of Guidance System Accuracy         |
| 1YXX-0501-09                | Redundant IMU's Collocated               |
| 1YXX-0501-11                | Improper Air Data/Loss of Data           |
| 1YXX-0501-12                | Exceeding Limit Load Factors             |
| 1YXX-0501-13                | Failure to Initiate Post ET Pitch-llp    |
| 1ZXX-0501-15                | Premature Pitch Down at Round Out        |
| 1YXX-0501-54                | Failure to Obtain FCS Check              |
| 1ZXX-0501-57                | Failure to Disable Body Flap             |
| 1ZXX-0502-02                | Corona and Arcing                        |
| 1YXX-0502-02-01             | Failure of Waveguide in RCS Bay          |
| 1ZXX-0503-02                | False Fire Alarm                         |
| 1ZXX-0503-03                | Failure to C&W to Alert                  |
| 1ZXX-0503-04                | Accidental Actuation of Switch           |
| 1ZXX-0503-05                | Insufficient C&W for BFCS Engage         |
| 1ZXX-0503-07                | False Alarm From C&W                     |
| 1ZXX-0503-09                | Delay in Back-up C&W                     |
| 1ZXX-0503-10                | Bus Failure for C&W                      |
| 1ZXX-0503-11                | Insufficient Time to Engage BFCS         |
| 1ZXX-0503-12                | Fails to Engage BFCS and Downmodes       |

(continued)

TABLE III

## HAZARD ANALYSIS MISSION PHASE LISTING

SUBSYSTEM GROUP: AVIONICS

| HAZARD NUMBER                       | PROBLEM DESCRIPTION                      |
|-------------------------------------|--|
| <u>DEORBIT THRU LANDING (Cont.)</u> |  |
| 1ZXX-0503-13                        | Failure in RHC                           |
| 1YXX-0503-14                        | False Rapid Depress Alarm                |
| 1YXX-0503-15                        | Rapid Depress Alarm Fails                |
| 1YXX-0503-23                        | No Alarm for CO <sub>2</sub> Build-up    |
| 1ZXX-0505-03                        | GPC Overload                             |
| 1ZXX-0505-04                        | Data Bus Coupler Ignition Source         |
| 1YXX-0506-03                        | Misfire of NLG Pyro                      |
| 1YXX-0506-04                        | Inadvertent Pyro Firing/Misfiring        |
| 1ZXX-0506-05                        | Inability to Close Speedbrake            |
| 1ZXX-0506-06                        | Lack of Redundant Relays                 |
| 1ZXX-0506-07                        | Inadequate Locking of Connectors         |
| 1ZXX-0506-08                        | Off Schedule Arming/Disarming of Systems |
| 1ZXX-0506-09                        | Failure to Protect Power Supply          |
| 1ZXX-0506-10                        | Failure to Deadface Guillotined Circuits |
| 1ZXX-0506-13                        | Circuit Breakers Slow Acting             |
| 1ZXX-0506-14                        | Unknown Relay State in Start-up          |
| 1ZXX-0506-15                        | Damage Susceptibility to Wiring Harness  |
| 1ZXX-0506-17                        | Remotely Actuated Doors - Power Loss     |
| 1ZXX-0506-18                        | Brakes Fail to Actuate                   |
| 1ZXX-0506-19                        | Nose Gear Steering Control Loss          |
| 1ZXX-0506-21                        | Loss of Power to Rudder                  |
| 1ZXX-0506-22                        | Loss of Power to Body Flap               |
| 1YXX-0506-23                        | Loss of Power to Payload Retention       |
| 1ZXX-0507-01                        | Power Interrupt Causes Shutdown          |
| 1ZXX-0507-03                        | Manual Override Lockout                  |
| 1YXX-0507-04                        | RCS Commands When Stowed                 |
| 1ZXX-0507-06                        | Use of "Loc-Tite" With Magnetic Tape     |

### HAZARD ANALYSIS LISTING

The tabular listing of hazard analyses are included. The initial and tracking level listings are as follows:

|       |   |
|-------|---|
| CA    | Catastrophic: no time available to accommodate potential hazard.                |
| CR    | Critical: time available to react to potentially hazardous situation.           |
| CA/CN | Catastrophic potential hazard having methodology identified to control hazard.. |
| CR/CN | Critical potential hazard having methodology identified to control hazard.      |
| CN/CN | Potential hazard that has been controlled or eliminated.                        |

Note: CA or CR tracking status indicates an open hazard. CA/CN or CR/CN indicates a conditionally control hazard and CN/CN is a closed hazard.

APPENDIX A

Avionics Systems Hazard Analysis Printout

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | H2D<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 12XX-0500-01              | AVIONICS-GENERAL                    | CR                  | CN/CN 23   | CONTROLLED       | 082974        |

## HAZARD DESCRIPTION

FAILURE TO KEY ELECTRICAL CONNECTORS IN A WAY THAT POSITIVELY PREVENTS INTERCHANGING WITH OTHER ACCESSIBLE CONNECTORS

| FLIGHT TEST        | GROUND TEST         | FERRY FLIGHTS | ORBITAL MISSION       | OTHER |
|--------------------|---------------------|---------------|-----------------------|-------|
| ALL MISSION PHASES |                     |               |                       | X     |
| PRELAUNCH          | LIFT OFF THRU ORBIT | ON ORBIT      | DE-ORBIT THRU LANDING |       |

HAZARD GROUP XX EQUIPMENT DAMAGE

RESP.ENGR. R.F.RAASCH

RELATED FMEAS

FMEA REQD YES NO

NONE

X

## REFERENCES

MSC 00134 REV A #32

## HAZARD CAUSES

ADJACENT CONNECTORS SIMILARLY KEYED AND CROSS CONNECTED OR INADEQUATE MARKING OF MATING PLUGS AND WIRE TO INDICATE CORRECT MATING CONNECTIONS OR TERMINATION POINTS

## HAZARD EFFECTS

DAMAGE TO EQUIPMENT

RELATED HAZARD ANALYSES

NONE

HAZARD NUMBER 1ZXX-0500-01

HAZARD IDENTIFICATION CONCURRENCE

| <u>DISPOSITION</u>   | <u>RESP GRP</u> | <u>ACTION DOCUMENTATION</u>       |
|--|-----------------|-----------------------------------|
| FUNCTIONAL LEAD -INTERFACE-  | SAFETY LEAD     | W.E.PLAISTED                      |
| 01-KEY CONNECTORS PER PARA 3.6.8.<br>OF MF0004-002   | 392-ALL         | MF0004-002                        |
| 02-PROVIDE DESIGN INSPECTION OF<br>WIRE SEGMENT HARNESS MOCK-UPS<br>PRIOR TO FABRICATION OF HAR-<br>NESS | 392-060         | ML0303-0014                       |
| 03-COLOR CODE ADJACENT CONNECTORS<br>WITH SIMILAR SIZED SHELLS   | 392             | ML0303-0014                       |
| 04-VERIFY LAY OF HARNESS UPON<br>INSTALLATION  | 392-060         | INSTALLATION<br>PRACTICE          |
| 05-VERIFY NUMBER MATCH OF CONN-<br>ECTOR HALF TO CONNECTOR HALF  | 047             | STANDARD INSPECTION<br>PROCEDURES |

CLOSURE RATIONALE

HAZARD CLOSED BASED ON ABOVE STEPS TAKEN IN CORRECTIVE ACTIONS  
AS STANDARD PRACTICE IN THE DESIGN, FABRICATION, INSTALLATION,  
AND INSPECTION OF WIRE SEGMENTS CONTAINING CONNECTING DEVICES

HAZARD DISPOSITION CONCURRENCE

| <u>FUNCTIONAL SUPERVISION DEP-GRP</u> | <u>DATE</u> | <u>SAFETY SUPERVISION</u> | <u>DATE</u> |
|---------------------------------------|-------------|---------------------------|-------------|
| -INTERFACE-                           | 101575      | F.J.ATTAWAY               | 101575      |

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| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | HZD<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 12XX-0500-02              | AVIONICS-GENERAL                    | CR                  | CN/CN 23   | CONTROLLED       | 011675        |

HAZARD DESCRIPTION

INADVERTENT USE OF COUNTERFEIT ELECTRONIC PARTS

| FLIGHT TEST                    | GROUND TEST         | FERRY FLIGHTS | ORBITAL MISSION       | OTHER |
|--------------------------------|---------------------|---------------|-----------------------|-------|
| ALL FLIGHT & GROUND OPERATIONS |                     |               |                       |       |
| PRELAUNCH                      | LIFT OFF THRU ORBIT | ON ORBIT      | DE-ORBIT THRU LANDING | X     |

| HAZARD GROUP | XX | EQUIPMENT FAILURE/DAMAGE | RESP.ENGR. | R.F.RAASCH |
|--------------|----|--------------------------|------------|------------|
|--------------|----|--------------------------|------------|------------|

RELATED FMEAS

FMEA REQD YES NO

FMEA SYSTEM

X

REFERENCES

MSC 00134 REV A #47

HAZARD CAUSES

01-MISLABELLING OF PARTS

02-FRAUDULENT MARKETING OF MISLABELLED PARTS

HAZARD EFFECTS

FAILURE OF EQUIPMENT OR DAMAGE TO ASSOCIATED CIRCUITRY

RELATED HAZARD ANALYSES

NONE

HAZARD NUMBER 12XX-0500-02

## HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD M.L.ADAMS

SAFETY LEAD W.E.PLAISTED

## DISPOSITION

RESP GRP ACTION DOCUMENTATION

01&amp;02

PARTICIPATE IN NASA-ALERT  
SYSTEM  
PROVIDE FOR CLOSELY CONTROLLED  
RELIABILITY & DEVELOPMENT  
TESTING  
CONDUCT FMEAS TO IDENTIFY  
SINGLE FAULT PATHS

394-400  
394-301  
394-101  
  
394-103

## CLOSURE RATIONALE

THIS HAZARD IS CLOSED BASED ON THE ADMINISTRATIVE SYSTEM SET UP  
IN THE R&S DESK INSTRUCTIONS TO ENSURE ACCOMPLISHMENT OF  
ITEMS NOTED IN CORRECTIVE ACTION, ABOVE

## HAZARD DISPOSITION CONCURRENCE

| FUNCTIONAL SUPERVISION | DEP-GRP | DATE   | SAFETY SUPERVISION | DATE   |
|------------------------|---------|--------|--------------------|--------|
| M.L.ADAMS              | 394-301 | 061875 | F.J.ATTAWAY        | 070775 |

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HA-TRACK

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| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | H2D<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 12XX-0500-03              | AVIONICS-GENERAL                    | CR                  | CN/CN 23   | CONTROLLED       | 011675        |

HAZARD DESCRIPTION

INJUDICIOUS APPLICATION OR INADEQUATE SCREENING OF WET SLUG  
TANTALUM CAPACITORS

| FLIGHT TEST                | GROUND TEST         | FERRY FLIGHTS | ORBITAL MISSION       | OTHER |
|----------------------------|---------------------|---------------|-----------------------|-------|
| ALL FLIGHT & GROUND PHASES |                     |               |                       | X     |
| PRELAUNCH                  | LIFT OFF THRU ORBIT | ON ORBIT      | DE-ORBIT THRU LANDING |       |

HAZARD GROUP XX EQUIPMENT DAMAGE

RESP.ENGR. R.F.RAASCH

RELATED FMEAS

FMEA REQD YES NO

N/A

X

REFERENCES

MSC 00134 #20

HAZARD CAUSES

ABSENCE OF SELECTION CONTROLS, SCREENING AND ABSENCE OF DEVICE  
APPLICATION ANALYSIS IN CIRCUITRY

HAZARD EFFECTS

POSSIBLE CHANGE IN CAPACITY OR RATING OF CAPACITOR & SUBSEQUENT  
FAILURE OF, OR DAMAGE TO ADJACENT OR ASSOCIATED CIRCUITRY

HAZARD NUMBER 12XX-0500-03

## RELATED HAZARD ANALYSES

-----

NONE

## HAZARD IDENTIFICATION CONCURRENCE

-----

FUNCTIONAL LEAD M.L.ADAMS

SAFETY LEAD W.E.PLAISTED

## DISPOSITION

-----

USER REQUIRED TO JUSTIFY SPECIFIC  
APPLICATION OF WET SLUG TANTALUM  
CAPACITORS.

## RESP GRP

-----

394-301

## ACTION DOCUMENTATION

-----

RI/SD IL 394-301-  
74-204 DTD 24  
SEPTEMBER 1974

## CLOSURE RATIONALE

-----

EACH USAGE OF WET SLUG TANTALUM CAPACITORS IS IDENTIFIED AND  
PROCESSED THROUGH NASA-JSC FOR PROJECT MANAGER APPROVAL PER  
NASA JSC LETTER N6/74-L172, DTD 20 AUG 1974, "USE OF WET TANTA-  
LUM SLUG CAPACITORS FOR THE SPACE SHUTTLE PROGRAM"

## HAZARD DISPOSITION CONCURRENCE

-----

FUNCTIONAL SUPERVISION DEP-GRP

-----

M.L.ADAMS

DATE

-----

394-301 030475

SAFETY SUPERVISION

-----

F.J.ATTAWAY

DATE

-----

030475

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | HZD<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 12XX-0500-04              | AVIONICS-GENERAL                    | CA                  | CN/CN 123  | CONTROLLED       | 071474        |

## HAZARD DESCRIPTION

MOMENTARY POWER INTERRUPTIONS TO CRITICAL ELECTRONIC EQUIPMENT

| FLIGHT TEST<br>ALL MISSION PHASES | GROUND TEST         | FERRY FLIGHTS | ORBITAL MISSION       | OTHER X |
|-----------------------------------|---------------------|---------------|-----------------------|---------|
| PRELAUNCH                         | LIFT OFF THRU ORBIT | ON ORBIT      | DE-ORBIT THRU LANDING |         |

HAZARD GROUP FF LOSS OF FLIGHT CONTROL

RESP.ENGR. R.F.RAASCH

## RELATED FMEAS

FMEA REQD YES NO

05-6(SERIES) PER PART

X

## REFERENCES

MSC-00135,REV A.,ITEM 39

## HAZARD CAUSES

01-LIGHTNING STRIKE  
02-PART FAILURE  
03-BUSS TRANSIENTS

## HAZARD EFFECTS

LOSS OF PERSONNEL AND/OR VEHICLE.WORST CASE

HAZARD NUMBER 12XX-0500-04

## RELATED HAZARD ANALYSES

01-12XX-0507-01, 12XX-0500-05, 03-12XX-0500-05

## HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD T.QUEBEBEAUX

SAFETY LEAD W.E.PLAISTED

## DISPOSITION

RESP GRP

ACTION DOCUMENTATION

01-MULTIPLE DC BUS SEGMENTS ON  
CRITICAL EQUIPMENT TO PRECLUDE  
COMPLETE POWER LOSS OR INTER-  
RUPTION AND ENSURE TWO OR MORE  
DC SUPPLY SOURCES TO THE  
EQUIPMENT PER THE RELATED VS70-  
SERIES POWER WIRING SCHEMATIC

392-610

VS70-SERIES WIRING  
DIAGRAMSUV-101 FLT OPS DOES  
NOT ALLOW FLT IN  
LIGHTNING ENVIRON

02-FMEA'S CONDUCTED ON SYSTEMS TO  
ENSURE FO/FS OR FS IN CRITICAL  
OPERATIONS

394-103

MCR 955

03-SEE HA 12XX-0500-05

## CLOSURE RATIONALE

HAZARD IS CLOSED BASED ON THE ACCOMPLISHMENT OF CORRECTIVE ACTION  
ITEMS LISTED ABOVE AND AS INDICATED IN CERTIFICATION PLAN  
SD74-SH-0049 (CALLING OUT THE VS70-SERIES WIRING DIAGRAMS) AND  
MCR 955

## HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP

DATE

SAFETY SUPERVISION

DATE

L.A.UPDEGRAFF

392-610 062075

F.J.ATTIWAY

070775

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HA-TRACK

01/27/77 PAGE 1

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | HZD<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1ZXX-0500-05              | ELECT.PWR.DIST & CON                | CR                  | CN/CN 12   | CONTROLLED       | 021475        |

HAZARD DESCRIPTION

INABILITY OF ELECTRONIC EQUIPMENT TO MAINTAIN UNDISTURBED  
OPERATION IN THE PRESENCE OF TRANSIENT SUPPLY VOLTAGE PULSES  
SHORTER THAN THE RESPONSE TIME OF POWER SYSTEM REGULATORS

| FLIGHT TEST        | GROUND TEST         | FERRY FLIGHTS | ORBITAL MISSION       | OTHER X |
|--------------------|---------------------|---------------|-----------------------|---------|
| ALL MISSION PHASES |                     |               |                       |         |
| PRELAUNCH          | LIFT OFF THRU ORBIT | ON ORBIT      | DE-ORBIT THRU LANDING |         |

HAZARD GROUP FF LOSS OF FLIGHT CONTROL

RESP.ENGR. R.F.RAASCH

RELATED FMEAS

FMEA REQD YES NO

05-6(SERIES) PER EQUIPMENT

X

REFERENCES

MSC 00134 REV A #149

HAZARD CAUSES

01-BUSS TRANSIENTS  
02-PART/EQUIPMENT FAILURE

HAZARD EFFECTS

EQUIPMENT DAMAGE AND POSSIBLE LOSS OF VEHICLE AND PERSONNEL

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HAZARD NUMBER 1ZXX-0500-05

## RELATED HAZARD ANALYSES

01-1ZXX-0500-04

## HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD -INTERFACE-

SAFETY LEAD W.E.PLAISTED

## DISPOSITION

RESP GRP

ACTION DOCUMENTATION

01-PARAGRAPH 3.2 OF MFC004-002  
REQUIRES DEFINITION OF POWER  
PROFILE FOR EACH EQUIPMENT  
SPECIFICATION. PARA 4. OF LRU  
SPECIFICATIONS DEFINE TESTS TO  
ENSURE COMPLIANCE

392

MF0004-002  
LRU SPECIFICATIONS

02-FMEA'S ARE CONDUCTED ON ALL  
AVIONIC EQUIPMENTS TO DETER-  
MINE CRITICAL FAILURE MODES  
AND ENSURE A MINIMUM FAIL  
SAFE CONDITION CAPABILITY OF  
THE EQUIPMENTS, AS INSTALLED.

394-103

EQUIPMENT FMEA'S  
(PER MCR 955)

## CLOSURE RATIONALE

HAZARD IS CLOSED BASED ON THE ASSURANCE THAT DEFINITION OF THE  
POWER ENVIRONMENT AND COMPLIANCE THERETO OBVIATES THE CONDITION  
UNDER WHICH THERE IS EXPOSURE TO THIS POTENTIAL HAZARD. LRU  
REDUNDANCY PER MCR 955 MINIMIZES IMPACT OF THE HAZARD

## HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP

DATE

SAFETY SUPERVISION

DATE

-INTERFACE-

F.J.ATTAWAY

070775



| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | H2D<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 12XX-0500-06              | AVIONICS-GENERAL                    | CA                  | CN/CN 123  | CONTROLLED       | 041974        |

## HAZARD DESCRIPTION

SPURIOUS IGNITION SOURCES IN ORBITER AVIONIC COMPARTMENTS

| FLIGHT TEST        | GROUND TEST         | FERRY FLIGHTS | ORBITAL MISSION       | OTHER |
|--------------------|---------------------|---------------|-----------------------|-------|
| ALL MISSION PHASES |                     |               |                       | X     |
| PRELAUNCH          | LIFT OFF THRU ORBIT | ON ORBIT      | DE-ORBIT THRU LANDING |       |

HAZARD GROUP CC FIRE &amp; EXPLOSION

RESP ENGR R.F.RAASCH

## RELATED FMEAS

FMEA REQD YES NO

NONE

X

## REFERENCES

SD74-SH-0223B, TABLE I, MFG004-002, MCR 2156 REV 1

## HAZARD CAUSES

- 01-NON-EXPLOSION PROOFING/HERMETIC SEALING IN POSSIBLE EXPLOSIVE ATMOSPHERES
- 02-DAMAGED WIRING HARNESSSES
- 03-INADEQUATE CIRCUIT PROTECTION

## HAZARD EFFECTS

POSSIBLE FIRE/EXPLOSION AND LOSS OF ORBITER &amp; PERSONNEL

HAZARD NUMBER 1ZXX-0500-06

RELATED HAZARD ANALYSIS

1ZXX-0206-1C, 1YXX-0211-1A, 1ZXX-0506-15, 1ZXX-0506-15

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD -INTERFACE-

SAFETY LEAD W.E.PLAISTED

DISPOSITION

RESP GRP

ACTION DOCUMENTATION

01-COMPARTMENTATION DOCUMENT  
SD74-SH-0223B, TABLE I, SPELLS  
OUT COMPARTMENTS AND ZONES  
REQUIRING EQUIPMENT EXPLOSION  
PROOFING.

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SD74-SH-0223-TABLE I  
REF:TABLE 3.2.1E-1  
MF0004-014B

02-SEE HA 1ZXX-0506-15

03-SEE HA'S 1ZXX-0506-11 AND  
1ZXX-0506-13

CLOSURE RATIONALE

HAZARD IS CLOSED AS ALL PROCUREMENT SPECIFICATIONS/DESIGN SPECS  
AND DRAWINGS ARE SCREENED AGAINST "ENVIRONMENTAL CRITERIA SPECI-  
FICATION" (MF0004-14B) AS DEFINED IN "ORBITER FIRE/TOXICITY  
SAFETY REQUIREMENTS" (SD74-SH-0223B) PER MCR 2156

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP

DATE

SAFETY SUPERVISION

DATE

T.QUEBEDEAUX

F.J.ATTAWAY

070775

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OK OPERATION | LEVEL<br>INIT TRACK | HZD<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1YXX-0500-07              | AVIONICS GENERAL                    | CA                  | 12         | DELETED          | 012175        |

## HAZARD DESCRIPTION

SHORT CIRCUITS IN BIOMED/COMMUNICATIONS WIRING INSIDE PRESSURE  
SUIT THAT CAUSE ELECTRIC SHOCK OR SUIT DAMAGE

| FLIGHT TEST                                  | GROUND TEST         | FERRY FLIGHTS | ORBITAL MISSION       | OTHER X |
|--|---------------------|---------------|-----------------------|---------|
| ALL MISSION PHASES WITH SUITED CREW ON-BOARD |                     |               |                       |         |
| PRELAUNCH                                    | LIFT OFF THRU ORBIT | ON ORBIT      | DE-ORBIT THRU LANDING |         |

HAZARD GROUP AA ELECTRICAL SHOCK

RESP.ENGR. R.F.RAASCH

## RELATED FMEAS

FMEA REQD YES NO

NONE

## REFERENCES

MSC 00134 REV A #226 , #227, #228

## HAZARD CAUSES

- 01-LACK OF ADEQUATE FUSING & CURRENT LIMITING DEVICES TO PREVENT  
IGNITION OF OXYGEN-SATURATED BODY HAIR AND SKIN.
- 02-LACK OF PROTECTION OF BIOMED/COMMUNICATION UMBILICAL FROM  
EXTERNAL ELECTRICALLY OR THERMALLY HOT DEVICES DURING EMER-  
GENCIES
- 03-ELECTRIC ENERGY SOURCES INSIDE SPACESUIT

HAZARD NUMBER 1YXX-0500-07

HAZARD EFFECTS

-----  
ELECTRICAL SHOCK AND POSSIBLE EQUIPMENT DAMAGE

RELATED HAZARD ANALYSIS

-----  
NONE

HAZARD IDENTIFICATION CONCURRENCE

-----  
FUNCTIONAL LEAD INTERFACE

SAFETY LEAD W.E.PLAISTED

DISPOSITION

RESP GRP ACTION DOCUMENTATION

-----  
SEE CLOSURE RATIONALE

CLOSURE RATIONALE

-----  
THIS HAZARD ANALYSIS HAS BEEN DELETED AS THE SPACESUIT IS  
GOVERNMENT FURNISHED EQUIPMENT.

45

SD77-SI-0001-06

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | HZO<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1ZXX-0500-08              | AVIONICS-GENERAL                    | CR                  | CN/CN 12   | CONTROLLED       | 010375        |

## HAZARD DESCRIPTION

FAILURE OF RELAYS, QUALIFIED UNDER LAUNCH AND BOOSTER CONDITIONS TO OPERATE UNDER QUIESCENT (VEHICLE COAST) CONDITIONS DUE TO FRICTION INDUCED IN RELAY TO PREVENT ACTUATION BY VIBRATION

FLIGHT TEST    GROUND TEST    FERRY FLIGHTS    ORBITAL MISSION X OTHER  
PRELAUNCH X LIFT OFF THRU ORBIT X ON ORBIT X DE-ORBIT THRU LANDING

HAZARD GROUP FF LOSS OF FLIGHT CONTROL    RESP ENGR R.F. RAASCH

## RELATED FMEAS

FMEA REQD YES NO

05-SERIES FMEAS

X

## REFERENCES

MC455-0129, MSC 00134, REV A #180, MC455-0128

## HAZARD CAUSES

01-RELAY MAY BE CRITICAL TO OPERATION  
02-FRICTION INDUCED IN RELAY IMPAIRS OPERATION IN ZERO 'G' CONDITION

## HAZARD EFFECTS

IF NOT CORRECTABLE, COULD CAUSE ABERRATIVE CONTROL ACTIONS

## RELATED HAZARD ANALYSIS

1ZXX-0506-06

HAZARD NUMBER 1ZXX-0500-06

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD ERNIE DEMARCHI

SAFETY LEAD W.E.PLAISTED

| <u>DISPOSITION</u>  | <u>RESP GRP</u> | <u>ACTION DOCUMENTATION</u> |
|---|-----------------|-----------------------------|
| 01-RELIABILITY REDUNDANCY PROGRAM IS APPLIED TO ORBITER DESIGN AS A PROGRAM DISCIPLINE TO ENSURE "FAIL OPERATIONAL" OR "FAIL SAFE" CRITERIA IMPLEMENTATION PER MCR-955. | 394-100         | MCR-955                     |
| 02-COMPONENT TESTING INCLUDES RELAY CONTACT TRANSFER UNDER VIBRATION CONDITIONS AND CONTACT TRANSFER UNDER NON-VIBRATION CONDITIONS PER MC455-0126, MC455-0129          | 392-620         | MFC004-C33                  |

CLOSURE RATIONALE

HAZARD IS CLOSED BASED ON THE ACCOMPLISHMENT OF THE RELIABILITY AND TESTING PROGRAMS SPECIFIED IN THE CORRECTIVE ACTION ABOVE PER MCR 955 AND MFC004-033

HAZARD DISPOSITION CONCURRENCE

| <u>FUNCTIONAL SUPERVISION</u> | <u>DEP-GRP</u> | <u>DATE</u> | <u>SAFETY SUPERVISION</u> | <u>DATE</u> |
|-------------------------------|----------------|-------------|---------------------------|-------------|
| ERNIE DEMARCHI,               | 392-620        | 062075      | F.J.ATTAWAY               | 070775      |

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT | HZD<br>TRACK | HAZARD<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------|--------------|---------------|------------------|---------------|
| 1YXX-0500-09              | ELECT.PWR.DIST.& CON                | CA            | CN/CN        | 123           | CONTROLLED       | 060874        |

## HAZARD DESCRIPTION

PREMATURE/FALSE INITIATION OF SEPARATION SEQUENCE(ET/SRB)

| FLIGHT TEST | GROUND TEST         | FERRY FLIGHTS | X ORBITAL MISSION     | OTHER |
|-------------|---------------------|---------------|-----------------------|-------|
| PRELAUNCH X | LIFT OFF THRU ORBIT | X ON ORBIT    | DE-ORBIT THRU LANDING |       |

HAZARD GROUP FF LOSS OF FLIGHT CONTROL

RESP.ENGR. R.F.RAASCH

## RELATED FMEAS

FMEA REQD YES NO

NONE

X

## REFERENCES

MSC 00134 REV A #33, MFG004-020

## HAZARD CAUSES

01-SEPARATION SENSORS TRIGGERED BY STRUCTURE DEFLECTION  
 02-SEPARATION SIGNAL GENERATED BY SYSTEM MALFUNCTION  
 03-INADVERTENT ACTUATION

## HAZARD EFFECTS

LOSS OF PERSONNEL OR VEHICLE. WORST CASE

## RELATED HAZARD ANALYSES

1Y3X-0203-01A, 1Y3X-0203-2A, 1Y3X-0207-13b, 1Y3X-0207-14b

HAZARD NUMBER 1YXX-0500-09

## HAZARD IDENTIFICATION CONCURRENCE

| DISPOSITION   | RESP GRP | ACTION DOCUMENTATION |
|---|----------|----------------------|
| 01-SEPARATION SENSORS NOT PART OF DESIGN  | 396-610  | NONE REQUIRED        |
| 02-SHORT CIRCUIT IMMUNE CIRCUITRY & MULTISEQUENCE, SERIAL INITIATED SYSTEM TO BE PROVIDED | 396-610  | MC450-0018           |
| 03-PROVIDE GUARDED SWITCHES   | 396-610  | VL70-730102          |

## CLOSURE RATIONALE

HAZARD IS CLOSED AS THE SELECTION OF DESIGN OPTIONS HAS NEGATED THE POSSIBILITY OF THE CITED CAUSES OCCURRING, PER MC450-0018 AND VL70-730102

## HAZARD DISPOSITION CONCURRENCE

| FUNCTIONAL SUPERVISION | DEP-GRP | DATE   | SAFETY SUPERVISION | DATE   |
|------------------------|---------|--------|--------------------|--------|
| L.A.UPEEGRAFF          | 392-610 | 062075 | F.J.ATTAWAY        | 070775 |



HA-TRACK

01/27/77 PAGE 1

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | HZO<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1ZXX-0501-01              | GUIDANCE-NAVIGATION                 | CA                  | 12         | DELETED          | 091873        |

HAZARD DESCRIPTION

ATTITUDE INDICATOR GIVES FALSE READING TO PILOT & MANUAL OVERRIDE  
INITIATED (SEE HA 1AXX-0503-25)

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SD77-SH-0001-06

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | H2D<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 12XX-0501-02              | GUIDANCE-NAVIGATION                 | CR                  | CN/CN 12   | CONTROLLED       | 092375        |

## HAZARD DESCRIPTION

LOSS OF IMU PLATFORM STABILITY

FLIGHT TEST X GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER  
 PRELAUNCH LIFT OFF THRU ORBIT X ON ORBIT X DE-ORBIT THRU LANDING X

HAZARD GROUP FF LOSS OF FLIGHT CONTROL RESP. ENGR R. RAASCH

## RELATED FMEAS

FMEA REQD YES NO

NONE

X

## REFERENCES

MC409-0004, MSC 00134 REV A, ITEM 26; MSC1 3080 DPS#16

## HAZARD CAUSES

- 01-POWER INTERRUPTION/LIGHTNING STRIKE
- 02-IMPROPER GYRO ROTATIONAL SPEEDS
- 03-CATASTROPHIC FAILURE OF UNIT

## HAZARD EFFECTS

ISSUANCE OF UNWANTED/UNCONTROLLABLE DISCRETES COULD CAUSE LOSS OF  
 GEN DATA UPDATE AND LOSS OF VEHICLE

## RELATED HAZARD ANALYSES

NONE

51

SD77-SII-0001-06

HAZARD NUMBER 12XX-0501-02

## HAZARD IDENTIFICATION CONCURRENCE

-----  
FUNCTIONAL LEAD C.P.MORAN

SAFETY LEAD W.E.PLAISTED

## DISPOSITION

RESP GRP ACTION DOCUMENTATION  
-----01-POWER FROM MULTIPLE 28 VDC  
BUS SEGMENTS VS70-710101

392-610 VS70-710101

02-FDI/BITE ASSESSES VALIDITY OF  
SYSTEMS PER MC409-0004 PARA  
3.2.1.3.1.(BITE) AND RI-  
SINGER SOW PARA 3.1.(FDI)

392-230 MC409-0004

03-TRIPLE REDUNDANT SYSTEM PER  
VL70-000265 (FO/FS)

392-230 VS70-710101

01-03 PROVIDE REDUNDANT IMU AND  
SELECTION CRITERIA PER SD74-SH-  
0270A "...REDUNDANCY MGT/MODING  
SEQUENCING & CONTROL

382-300 SD74-SH-0270A

## CLOSURE RATIONALE

-----  
HAZARD IS CLOSED BASED ON THE POWER REDUNDANCY, FUNCTIONAL  
REDUNDANCY AND ASSESSMENT OF CAPABILITY OF THE SUBSYSTEM AS  
ACCOMPLISHED IN THE CORRECTIVE ACTION ABOVE

## HAZARD DISPOSITION CONCURRENCE

-----  
FUNCTIONAL SUPERVISION DEP-GRP

DATE

SAFETY SUPERVISION

DATE  
-----

-INTERFACE-

F.J.ATTAWAY

070775

HA-TRACK

01/27/77 PAGE 1

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT | TRACK | H2D<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------|-------|------------|------------------|---------------|
| 1ZXX-0501-03              | GUIDANCE-NAVIGATION                 | CA            | CN/CN | 12         | DELETED          | 092073        |

HAZARD DESCRIPTION

-----  
PYROTECHNIC ACTUATION IN ERROR (SEE HA:1A6X-0506-02)

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SD77-SH-0001-06

| HAZARD ANALYSIS NUMBER | SUBSYSTEM/EQUIPMENT OR OPERATION | LEVEL INIT | H2D TRACK | HAZARD STATUS | ENTRY DATE |
|------------------------|----------------------------------|------------|-----------|---------------|------------|
| 1YXX-0501-04           | GUIDANCE-NAVIGATION              | CR         | CR/CN 2   | IN-WORK       | 082974     |

## HAZARD DESCRIPTION

FALSE LOCK-ON/UNLOCK OF STAR TRACKER OPTICS

| FLIGHT TEST | GROUND TEST         | FERRY FLIGHTS | ORBITAL MISSION | X OTHER      |
|-------------|---------------------|---------------|-----------------|--------------|
| PRELAUNCH   | LIFT OFF THRU CRUIT | ON ORBIT      | X DE-ORBIT      | THRU LANDING |

HAZARD GROUP FF LOSS OF FLIGHT CONTROL

RESP. FCNK. R.F. RAASCH

RELATED FMEAS

FMEA REQD YES NO

NONE

X

REFERENCES

MSC-00134 REV A, ITEM 157

HAZARD CAUSES

- 01-FALSE STARS(ILLUMINATED LOCAL CONTAMINANTS)
- 02-LOCK-ON SENSITIVITY THRESHOLD ANOMALY
- 03-UNCATALOGUED STAR

HAZARD EFFECTS

IMPROPER SELLING SIGNALS TO CYRUS COULD CAUSE LOSS OF ABILITY TO ACHIEVE DESIRED LANDING SITE DUE TO ERRORS AT ENTRY INTERFACE. INCORRECT FLIGHT PATH ANGLE COULD RESULT IN EXCESSIVE HEATING AT ENTRY

HAZARD NUMBER 1YXX-0501-04

## RELATED HAZARD ANALYSES

-----

1YXX-0501-02

## HAZARD IDENTIFICATION CONCURRENCE

-----

FUNCTIONAL LEAD PETE TANNER

SAFETY LEAD W.E. PLAISTED

## DISPOSITION

-----

01-03 REQUIRE PERIODIC RETEST  
AGAINST IMU POSITION  
REQUIRE PERIODIC DRIFT/RATE  
CHECK  
REQUIRE PERIODIC MAGNITUDE  
CHECK  
04-REQUIRE INITIAL STAR ID

## RESP GRP

-----

352-230

## ACTION DOCUMENTATION

-----

SAIL TESTING

SAIL TESTING

SAIL TESTING

FLIGHT DATA FILE  
PROCEDURES

SS

SD 77-SH-0001-06

ORIGINAL PAGE IS  
OF POOR QUALITY

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | HZD<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1YXX-0501-06              | GUIDANCE-NAVIGATION                 | CA CN/CN            | 12         | CONTROLLED       | 082974        |

## HAZARD DESCRIPTION

## INABILITY TO ACCESS TAEMS

| FLIGHT TEST X<br>PRELAUNCH | GROUND TEST<br>LIFT OFF THRU ORBIT | FERRY FLIGHTS<br>ON ORBIT | ORBITAL MISSION X<br>DE-ORBIT THRU LANDING X | OTHER |
|----------------------------|------------------------------------|---------------------------|--|-------|
|                            |                                    |                           |  |       |

| HAZARD GROUP | FF LOSS OF FLIGHT CONTROL | RESP. ENGR R.RAASCH |
|--------------|---------------------------|---------------------|
|              |                           |                     |

## RELATED FMEAS

FMEA REQD YES NO

NONE

X

## REFERENCES

PHASE "B" HA#1.1-01,-15,-16&amp;-23;MSC-00134 REV A,ITEM 172

## HAZARD CAUSES

- 01-WEATHER (APPROACH & LANDING)
- 02-INABILITY TO POSITION VEHICLE IN MSBLS ANTENNA PATTERN
- 03-LOSS OF MSBLS CAPABILITY
- 04-INTERFACE-IMPROPER ATTITUDE & POSITION DATA FROM STAR TRACKER
- 05-LACK OF MSBLS OR OTHER LANDING AIDS AT CONTINGENCY LANDING SITE.

## HAZARD EFFECTS

LOSS OF VEHICLE AND PERSONNEL DUE TO ENERGY DEPLETION. IMPROPER ENTRY ATTITUDE POSITIONING, OR OTHER FACTORS INTERFERING WITH APPROACH & LANDING

HAZARD NUMBER 1YXX-0501-06

RELATED HAZARD ANALYSES

04-12XX-0501-02; 1YXX-0501-04, 12XX-0501-08

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD JOE MURRAY

SAFETY LEAD W.E.PLAISTED

DISPOSITION

RESP GRP ACTION DOCUMENTATION

01-PROVIDE ALL WEATHER LANDING  
CAPABILITY PER VL70-000265  
(TACAN,RADAR ALT., MSBLS WITH  
C&S-BANDS RADAR BACK-UP)392-420 VL70-000265  
43002-DEVELOP TERMINAL AREA ENERGY  
MANAGEMENT TECHNIQUES(TAEM)

390-400 ALT FLIGHTS

03-SAME AS 01-ABOVE

05-DEVELOP TERMINAL AREA ENERGY  
MANAGEMENT TECHNIQUES FOR  
CONTINGENCY LANDING SITES.

ALT FLIGHTS

CLOSURE RATIONALEHAZARD IS CLOSED BASED ON DEMONSTRATION OF TAEM TECHNIQUES IN  
THE ALT FLIGHT TEST PROGRAM AND THE STA TAEM DEVELOPMENT FLIGHT  
TEST PROGRAMHAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP

DATE

SAFETY SUPERVISION

DATE

-INTERFACE-

F.J.ATTAWAY

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HA-TRACK

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| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | HZD<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1ZXX-0501-07              | FLIGHT CONTRL                       | CR CN/CN            | 12         | CONTROLLED       | 091974        |

HAZARD DESCRIPTION

LOSS OF RATE GYRO STABILITY

FLIGHT TEST X GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER  
PRELAUNCH LIFT OFF THRU ORBIT X ON ORBIT X DE-ORBIT THRU LANDING X

HAZARD GROUP FF LOSS OF FLIGHT CONTROL RESP. ENGR R.RAASCH

RELATED FMEAS

FMEA REQD YES NO

NONE

X

REFERENCES

MC493-0015; MSC-00134 REV A, ITEM 26; MSC1 8080, DPS#6

HAZARD CAUSES

- 01-POWER INTERRUPTION/LIGHTNING STRIKE
- 02-IMPROPER GYRO ROTATIONAL SPEEDS
- 03-LOSS OF SENSE DATA
- 04-IMPROPER FREQUENCY RESPONSE

HAZARD EFFECTS

LOSS OF STABILITY REFERENCE COULD CAUSE LOSS OF ORBITER VEHICLE  
AND CREW IF ALL GYRO ASSEMBLIES FAIL

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SD77-SH-0001-06

HAZARD NUMBER 1ZXX-0501-07

RELATED HAZARD ANALYSES1ZXX-0501-02HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD W.TALBOTT

SAFETY LEAD W.E.PLAISTED

DISPOSITIONRESP GRP ACTION DOCUMENTATION01-POWER FROM MULTIPLE 28VDC BUS  
SEGMENTS PER VS70-790581, SHT 3

392-610 VS70-790581

02-INCORPORATE SPIN MOTOR ROTA-  
TION DETECTORS (SMRDS) PER  
MC493-0015

392-230 MC493-0015

03-PROVIDE REDUNDANT RATE GYRO  
& SELECTION CRITERIA  
(BITE IS PROVIDED IN CURRENT  
DESIGN)382-300 SD74-SH-0270A  
REF:MCR 3915

04-SAME AS 03 ABOVE

CLOSURE RATIONALEHAZARD IS CLOSED BASED ON THE POWER REDUNDANCY, FUNCTIONAL  
REDUNDANCY AND ASSESSMENT OF CAPABILITY OF THE SUBSYSTEM AS  
ACCOMPLISHED IN THE CORRECTIVE ACTION ABOVEHAZARD DISPOSITION CONCURRENCEFUNCTIONAL SUPERVISION DEP-GRPDATESAFETY SUPERVISIONDATE-INTERFACE-

F.J.ATTAWAY

070775

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SD77-SH-0001-06

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | HZD<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1YXX-0501-08              | GUIDANCE/NAVIGATION                 | CR                  | CN/CN 12   | CONTROLLED       | 121374        |

## HAZARD DESCRIPTION

LOSS OF GUIDANCE SYSTEM ACCURACY

| FLIGHT TEST<br>PRELAUNCH | GROUND TEST<br>LIFT OFF THRU ORBIT | FERRY FLIGHTS<br>X ON ORBIT | ORBITAL MISSION<br>X DE-ORBIT THRU LANDING | OTHER<br>X |
|--------------------------|------------------------------------|-----------------------------|--|------------|
|                          |                                    |                             |  |            |

HAZARD GROUP FF LOSS OF FLIGHT CONTROL RESP.ENGR. R.F.RAASCH

## RELATED FMEAS

FMEA REQD YES NO

NONE

X

## REFERENCES

MSC 00134 REV A #172

## HAZARD CAUSES

- 01-WARPAGE OF NAV BASE STRUCTURE
- 02-IMPROPERLY KEYED ACCELEROMETERS
- 03-ERRONEOUS IMU UPDATE
- 04-REINSTALLATION OF IMU'S WITH PROTRUSIONS UNDER IMU PADS
- 05-DAMAGE TO NAV BASE STRUCTURE

## HAZARD EFFECTS

LOSS OF GUIDANCE ACCURACY, IF UNDETECTED , COULD LEAD TO LOSS OF VEHICLE AND PERSONNEL

HAZARD NUMBER 1YXX-0501-08

RELATED HAZARD ANALYSES

12XX-0501-02

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD C.P.MORAN

SAFETY LEAD W.E.PLAISTED

DISPOSITIONRESP GRP ACTION DOCUMENTATION

01-STRUCTURE/VIBRATION TESTING  
PLANNED IN THERMAL ENVIRON-  
MENTS PER STRUCTURAL TEST  
C-30.

QUALIFICATION TESTS  
PROCEDURE

DESIGN TO PREVENT WARPAGE

MCR 3930  
TEST & CHECKOUT  
PROCEDURE

02-CALIBRATION TESTS AT MFG AND  
IN USER'S FACILITY PRECLUDE  
GROSS INSTALLATION MISALIGN-  
MENT FROM BEING UNDETECTED

ADL/SAIL CHECKOUT  
PROCEDURE

03-REDUNDANCY MANAGEMENT CRITERIA  
VOTING LOGIC COMPARES IMU UP-  
DATE DATA PER SD-74-SH-0270A  
LEVEL "C" PART "D"

TEST & CHECKOUT  
PROCEDURE

04-REQUIRES TEST & CHECKOUT  
PROCEDURES TO CHECK ON PAD &  
NAV BASE PROTRUSION THAT COULD  
CAUSE ERRONEOUS IMU ALIGNMENT.

TEST & CHECKOUT  
PROCEDURE

05-PERIODIC NAV BASE CALIBRATION  
REQUIRED

CLOSURE RATIONALE

HAZARD IS CLOSED BASED ON THE ACCOMPLISHMENT OF TESTS IN ADL/SAIL  
AND THE CORRECTIVE ACTIONS ABOVE.

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | H2D<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1YXX-0501-09              | GUIDANCE/NAVIGATION                 | CA CA               | 123        | RESIDUAL         | 080274        |

#### HAZARD DESCRIPTION

REDUNDANT PATHS NOT ADEQUATELY SEPARATED - IMU'S COLOCATED

| FLIGHT TEST | GROUND TEST         | FERRY FLIGHTS | ORBITAL MISSION         | X OTHER |
|-------------|---------------------|---------------|-------------------------|---------|
| PRELAUNCH   | LIFT OFF THRU ORBIT | X ON ORBIT    | X DE-ORBIT THRU LANDING | X       |

| HAZARD GROUP | FF LOSS OF FLIGHT CONTROL | RESP.ENGR. | R.F.RAASCH |
|--------------|---------------------------|------------|------------|
| -----        | -----                     | -----      | -----      |

#### RELATED FMEAS

NONE

| FMEA REQD | YES   | NO    |
|-----------|-------|-------|
| -----     | ----- | ----- |

X

#### REFERENCES

MSC-00134 REV A #4, MC409-0004

#### HAZARD CAUSES

01-CASCADING INTERNAL SHRAPNEL ADJACENT DESTRUCTIVE EFFECTS  
02-LOSS OF COOLING AIR - SINGLE HEAT EXCHANGER, SINGLE PLENUM

#### HAZARD EFFECTS

SINGLE COMPARTMENT INCIDENT COULD CAUSE LOSS OF GUIDANCE/NAV  
CAPABILITY AND SUBSEQUENT LOSS OF VEHICLE AND PERSONNEL

HAZARD NUMBER 1YXX-0501-09

RELATED HAZARD ANALYSES

NONE

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD C.P.MORAN

SAFETY LEAD W.E.PLAISTED

DISPOSITIONRESP GRP ACTION DOCUMENTATION

SEE DISPOSITION RATIONALE

DISPOSITION RATIONALE

THIS HAZARD IS RESIDUAL IN THAT A SINGLE COMPARTMENT DAMAGING EVENT WOULD BE CATASTROPHIC. HORIZONTAL ALIGNMENT CONSTRAINTS DICTATE IMU COLOCATION TO ACHIEVE REQUIRED ACCURACIES. IMU'S SHARE CABIN ENVIRONMENT AND ENJOY THE SAME FO/FS REDUNDANCY AS THE CREW AND, AS SUCH, ARE EXPOSED TO THE SAME RISK LEVEL AS THE CREW

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | H2D<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE     |
|---------------------------|-------------------------------------|---------------------|------------|------------------|-------------------|
| 1YXX-0501-11              | GUIDANCE-NAVIGATION                 | CA                  | CN/CN      | 2                | CONTROLLED 082974 |

## HAZARD DESCRIPTION

IMPROPER AIR DATA INPUTS OR LOSS OF AIR DATA INPUTS

| FLIGHT TEST | GROUND TEST         | FERRY FLIGHTS | ORBITAL MISSION       | OTHER |
|-------------|---------------------|---------------|-----------------------|-------|
| PRELAUNCH   | LIFT OFF THRU ORBIT | ON ORBIT      | DE-ORBIT THRU LANDING | X     |

HAZARD GROUP FF LOSS OF FLIGHT CONTROL

RESP. ENGR. R.F. KAASCH

RELATED FMEAS

FMEA REQD YES NO

05-1-GN28-1

X

## REFERENCES

PHASE "B" #1.1-18, MPMA A-18.4, ILJES-100-JBP-76-C18

## HAZARD CAUSES

01-AIR DATA SYSTEM NOT CALIBRATED  
02-PROBES NOT DEPLOYED

## HAZARD EFFECTS

WITHOUT ACCURATE AIR DATA, THE VEHICLE COULD BE LOST FROM:  
OVERSTRESSING, MISSING LANDING POINT, CRASH LANDING FOLLOWING  
STALL, AND OVERRUNNING RUNWAY

## RELATED HAZARD ANALYSES

12XX-0209-02-01, 12XX-0209-02-02, 1AXX-0501-05

HAZARD NUMBER 1YXX-0501-11

## HAZARD IDENTIFICATION CONCURRENCE

-----  
FUNCTIONAL LEAD -INTERFACE-

SAFETY LEAD W.E. PLAISTED

## DISPOSITION

## RESP GRP

## ACTION DOCUMENTATION

01002-NAV DERIVED AIR DATA CPS  
IS BEING EXTENDED FROM 100,000  
FT DOWN TO GROUND LEVEL

383-100

IL383-100-JBP-76-018  
DTD 14 SEP 76SOFTWARE CONFIGURED TO ACCEPT  
ALTITUDE UPDATE

"

APPLICATION PROGRAMS TO DE-  
SENSITIZE THEMSELVES TO IN-  
ACCURATE AIR DATA: NAV LOCKS  
OUT BARO ALTIMETER INPUT IN  
TRANSONIC REGION

"

PLACARD INITIAL DFT FLTS FOR  
LIMITED WIND CONDITIONS

394-400

IL394-400-76-162, DTD  
5 OCT 76

## CLOSURE RATIONALE

-----  
HAZARD IS CLOSED AS PRECAUTIONS ARE BEING TAKEN TO DISALLOW  
EXPOSURE THROUGH THE CAUSES NOTED (REF: NOTED DOCUMENTS)

## HAZARD DISPOSITION CONCURRENCE

-----  
FUNCTIONAL SUPERVISION DEP-GRP

DATE

SAFETY SUPERVISION

DATE  
-----

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ORIGINAL PAGE IS  
OF POOR QUALITY



HA-TRACK

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| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | HZD<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1YXX-0501-12              | GN&C                                | CA                  | CN/CN      | U12 CONTROLLED   | 071276        |

HAZARD DESCRIPTION

EXCEEDING LIMIT LOAD FACTORS DURING ENTRY/MINI-ENTRY

| FLIGHT TEST<br>PRELAUNCH | GROUND TEST<br>LIFT OFF THRU ORBIT | FERRY FLIGHTS<br>ON ORBIT | ORBITAL MISSION<br>DE-ORBIT THRU LANDING | OTHER<br>X |
|--------------------------|------------------------------------|---------------------------|--|------------|
|--------------------------|------------------------------------|---------------------------|--|------------|

|  |                         |
|--|-------------------------|
| HAZARD GROUP FF LOSS OF FLIGHT CONTROL | RESP. ENGR. R.F. RAASCH |
|--|-------------------------|

RELATED FMEAS

SEE RELATED HA'S

FMEA REQD YES NO

X

REFERENCES

RTLS MPHA

HAZARD CAUSES

- 01-LOSS OF OR IMPROPER LOAD LIMITS AND/OR DISPLACEMENTS
- 02-FAILURE OF BALLISTIC CONTROL SYSTEM
- 03-FAILURE OF AERO CONTROL SYSTEM
- 04-STRUCTURAL HEATING BEYOND ALLOWABLES

HAZARD EFFECTS

BREAKUP OF AND/OR LOSS OF VEHICLE THROUGH OFF-DESIGN AERO-THERMAL LOADS EFFECTS.

RELATED HAZARD ANALYSES

02-1YXX-0302-SERIES; 03-1ZXX-0209-SERIES; 04-1ZXX-0100-SERIES

HAZARD NUMBER 1YXX-0501-12

## HAZARD IDENTIFICATION CONCURRENCE

-----  
FUNCTIONAL LEAD -INTERFACE-

SAFETY LEAD W.E.PLAISTED

## DISPOSITION

RESP GRP ACTION DOCUMENTATION  
-----01&04-ESTABLISH "NOT TO EXCEED"  
ALPHA LIMITS IN OSOP PER  
SD73-SH-0178-1C FOR ALPHA,  
DYNAMIC PRESSURE, "G" LOADING  
IN ALL AXES

394-400 1L394-400-76-161

PROVIDE MEANS TO DETERMINE  
LOAD FACTORSBASELINE-INSTL OF  
ACCELEROMETERS  
IN INSTR. PANEL

02&amp;03-FO/FS (PFCS/EFCS) SYSTEMS

BASELINE ON OV-102

## CLOSURE RATIONALE

-----  
THIS HAZARD IS CLOSED AS PILOT MONITORING OF AUTOMATIC FUNCTIONS  
IS PROVIDED THROUGH PANEL INSTALLED ACCELEROMETERS, OPERATIONAL  
CAUTIONS WARNINGS AND NOTES ARE TO APPEAR IN THE OV-102 DATA  
FILE, AND MULTIPLE FAILURE TOLERANT CONTROL SYSTEMS ARE  
PROVIDED

## HAZARD DISPOSITION CONCURRENCE

-----  
FUNCTIONAL SUPERVISION DEP-GRP DATE SAFETY SUPERVISION DATE  
-----  
-INTERFACE- F.J.ATTAWAY

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | HZD<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1YXX-0501-13              | GN&C                                | CA CA               | 012        | IN WORK          | 081276        |

## HAZARD DESCRIPTION

FAILURE TO INITIATE POST ET SEPARATION ORBITER PITCH-UP DURING  
RTLS ABORT

| FLIGHT TEST X | GROUND TEST         | FERRY FLIGHTS | ORBITAL MISSION       | OTHER |
|---------------|---------------------|---------------|-----------------------|-------|
| PRELAUNCH     | LIFT OFF THRU ORBIT | X ON ORBIT    | DE-ORBIT THRU LANDING | X     |

HAZARD GROUP FF LOSS OF FLIGHT CONTROL

RESP.ENGR. R.F.RAASCH

RELATED FMEAS

FMEA REQD YES NO

NONE

X

REFERENCES

RTLS MPHA, MGO36100-SERIES

HAZARD CAUSES

01-GENERIC SOFTWARE FAULT  
02-BALLISTIC/AERO CONTROL FAILURE

HAZARD EFFECTS

THERMAL LOAD EFFECTS.  
BREAK-UP OF AND/OR LOSS OF VEHICLE THROUGH OFF DESIGN AERO-

RELATED HAZARD ANALYSES

1YXX-0505-02

HAZARD NUMBER 1YXX-0501-13

## HAZARD IDENTIFICATION CONCURRENCE

-----  
FUNCTIONAL LEAD -INTERFACE-

SAFETY LEAD W.E.PLAISTED

## DISPOSITION

RESP GRP ACTION DOCUMENTATION

-----  
01-BACK UP TO BE PROVIDED FOR  
GENERIC SOFTWARE FAULT-----  
(NOT BASELINED)CREW SHOULD BE ALERTED TO  
PITCH-UP REQUIREMENT IN OFT  
DATA FILEIL394-400-76-161 DTO  
5 OCT 7602-MULTIPLE REDUNDANCY OF BOTH  
AERO & BALLISTIC CONTROL  
SYSTEMS PROVIDES CONFIDENCE  
THAT FUNCTIONS WILL BE AVAIL-  
ABLE WHEN NEEDED

ORBITER BASELINE

HA-TRACK

01/27/77 PAGE 1

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT | TRACK | H2D<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------|-------|------------|------------------|---------------|
| 12XX-0501-15              | GN&C                                | CA            | CA    |            | IN-WORK          | 091476        |

HAZARD DESCRIPTION

PREMATURE NOSE PITCH DOWN AT ROUND OUT - AUTOLAND MODE ONLY

| FLIGHT TEST<br>PRELAUNCH | GROUND TEST<br>LIFT OFF THRU ORBIT | FERRY FLIGHTS<br>ON ORBIT | ORBITAL MISSION<br>DE-ORBIT THRU LANDING | OTHER<br>X |
|--------------------------|------------------------------------|---------------------------|--|------------|
|--------------------------|------------------------------------|---------------------------|--|------------|

|  |                       |
|--|-----------------------|
| HAZARD GROUP FF LOSS OF FLIGHT CONTROL | RESP.ENGR. R.F.RAASCH |
|--|-----------------------|

RELATED FMEAS

FMEA REQD YES NO

REFERENCES

HAZARD CAUSES

01-FAILURE OF WOW CIRCUITRY AT ROUND OUT

HAZARD EFFECTS

FAILED WOW CIRCUITRY AT ROUND OUT MAKES SOFTWARE BELIEVE THAT THE ORBITER HAS TOUCHED DOWN AND PREMATURE NOSE PITCH DOWN OCCURS, CAUSING POSSIBLE CRASH LANDING WITH DAMAGE TO VEHICLE AND INJURY OR LOSS OF CREW

RELATED HAZARD ANALYSES

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SD77-SH-0001-06

HAZARD NUMBER 12XX-0501-15

HAZARD IDENTIFICATION CONCURRENCE  
-----

FUNCTIONAL LEAD -INTERFACE-

SAFETY LEAD W.E.PLAISTED

DISPOSITION  
-----RESP GRP ACTION DOCUMENTATION  
-----

ON OV-101 WOW CIRCUITRY IS MONI-  
TORED BY TM & CREW IS ADVISED OF  
SYSTEM INTEGRITY BY VOICE FROM  
GROUND - IF FAULTED, GO MANUAL

ON OV-102 SYSTEM DESIGN IS NOT  
RESOLVED AS TO HOW TO AVOID EX-  
POSURE TO PROBLEM

71

SD77-SH-0001-06

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | HZD<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1YXX-0501-50              | FLIGHT CONTROL                      | CA                  | CN/CN 12   | CONTROLLED       | 080874        |

HAZARD DESCRIPTION

FALSE INITIATION OF AUTO SHUTDOWN OF SSME'S

| FLIGHT TEST<br>PRELAUNCH | GROUND TEST<br>LIFT OFF THRU | FERRY FLIGHTS<br>ORBIT X ON ORBIT | ORBITAL MISSION<br>DE-ORBIT THRU | OTHER<br>LANDING |
|--------------------------|------------------------------|-----------------------------------|----------------------------------|------------------|
|--------------------------|------------------------------|-----------------------------------|----------------------------------|------------------|

|  |                       |
|--|-----------------------|
| HAZARD GROUP FF LOSS OF FLIGHT CONTROL | RESP.ENGR. R.F.RAASCH |
|--|-----------------------|

RELATED FMEAS

FMEA REQD YES NO

NONE - SEE MCR 0274

REFERENCESMSCI 8080 DPS#48, MSC 00134 REV A #34, MCR 0274 REV A  
SD75-SH-0064-CUNCER #17HAZARD CAUSES01-EMI(LIGHTNING/TRANSIENT SIGNAL INDUCTION)  
02-LOCK-OUT MALFUNCTION (ELECTROMECHANICAL INTERFACES)  
03-POWER INTERRUPTION  
04-ENGINE KILL CIRCUITRY LIVE AFTER HOLDOWN RELEASEHAZARD EFFECTS

IF BEYOND ABORT CAPABILITY, LOSS OF VEHICLE AND PERSONNEL

HAZARD NUMBER 1YXX-0501-50

## RELATED HAZARD ANALYSES

-----  
1ZXX-0500-04

## HAZARD IDENTIFICATION CONCURRENCE

-----  
FUNCTIONAL LEAD -INTERFACE-

SAFETY LEAD W.E.PLAISTED

## DISPOSITION

RESP GRP ACTION DOCUMENTATION

-----  
PROVIDE ASSURANCE THAT LIGHTNING  
& SNEAK CIRCUIT ASSESSMENT WILL  
ADDRESS HAZARD CAUSES.

## CLOSURE RATIONALE

-----  
THIS HAZARD IS CLOSED AS SNEAK CIRCUIT EFFORT AND PLANNED NON-  
DESTRUCTIVE LIGHTNING TESTING BOTH ADDRESS THE CAUSES OF THE  
HAZARD.



HA-TRACK

01/27/77 PAGE 1

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | HZD<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1ZXX-0501-52              | FLIGHT CONTROL                      |                     |            | DELETED          | 080674        |

HAZARD DESCRIPTION

FLIGHT CONTROL COMPUTER OUTPUT ERROR(SEE HA'S 1YXX-0507-04 & -05)

HA-TRACK

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| HAZARD ANALYSIS<br>NUMBER   | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | HZD<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---|-------------------------------------|---------------------|------------|------------------|---------------|
| 1YXX-0501-53  | FLIGHT CONTROL                      |                     |            | DELETED          | 080674        |
| HAZARD DESCRIPTION  |                                     |                     |            |                  |               |
| SELECTED MULTIPLE FAILURES OF ATTITUDE CONTROL DRIVER UNITS<br>FUNCTION (SEE HA'S 1YXX-0507-04 & -05) |                                     |                     |            |                  |               |

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HA-TRACK

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| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | HZD<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1YXX-0501-54              | FLIGHT CONTROL SYS                  | CA                  | LN/LN 123  | CONTROLLED       | 021375        |

HAZARD DESCRIPTION

FAILURE TO OBTAIN A FINAL END-TO-END CHECK OF SHUTTLE VEHICLE  
CONTROL AND STABILIZATION SYSTEMS IN THE LAUNCH CONFIGURATION

| FLIGHT TEST | GROUND TEST           | FERRY FLIGHTS | ORBITAL MISSION         | OTHER |
|-------------|-----------------------|---------------|-------------------------|-------|
| PRELAUNCH X | LIFT OFF THRU ORBIT X | ON ORBIT      | DE-ORBIT THRU LANDING X |       |

HAZARD GROUP FF LOSS OF FLIGHT CONTROL

KESP. ENGR. R.F. RAASCH

RELATED FMEAS

FMEA REQD YES NO

NONE

X

REFERENCES

MSC 00134 REV A #142

HAZARD CAUSES

NO REQUIREMENT FOR END TO END CHECKOUT

HAZARD EFFECTS

POSSIBLE LOSS OF VEHICLE AND PERSONNEL DUE TO FCS MALFUNCTION

RELATED HAZARD ANALYSIS

NONE

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HAZARD NUMBER 1YXX-0501-54

HAZARD IDENTIFICATION CONCURRENCE  
-----

FUNCTIONAL LEAD PAUL GARCIA

SAFETY LEAD W.E.PLAISTED

DISPOSITION  
-----

END-TO-END TEST REQUIRMENT SPECI-  
FICATION DOCUMENT (TRSD) ML 0101-  
0001 IS TO EXERCISE THE FLIGHT  
CONTROL SYSTEM

RESP GRP ACTION DOCUMENTATION  
-----

TEST REQ SPEC DOC  
ML0101-0001  
REF:MCR-3444

CLOSURE RATIONALE  
-----

THIS HAZARD IS CLOSED AS THE NOTED TEST DOCUMENT INCORPORATES  
THE NEEDED TEST REQUIREMENT

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SD77-SH-0001-06

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | HZO<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1YXX-0501-55              | FLIGHT CONTROL SYST.                | CR                  | CN/CN 12   | DELETED          | 012175        |

## HAZARD DESCRIPTION

DOCKING WITHOUT DEACTIVATING INCOMPATIBLE VEHICLE STABILIZATION SYSTEMS

| FLIGHT TEST<br>PRELAUNCH | GROUND TEST<br>LIFT OFF THRU ORBIT | FERRY FLIGHTS<br>ON ORBIT | ORBITAL MISSION<br>X DE-ORBIT | OTHER<br>THRU LANDING |
|--------------------------|------------------------------------|---------------------------|-------------------------------|-----------------------|
|                          |                                    |                           |                               |                       |

| HAZARD GROUP | FF LOSS OF FLIGHT CONTROL | RESP ENGR | R.F.RAASCH |
|--------------|---------------------------|-----------|------------|
|              |                           |           |            |

## RELATED FMEAS

NONE

FMEA REQD YES NO

X

## REFERENCES

MSC 00135 REV A #250

## HAZARD CAUSES

- 01-SEVERE OSCILLATIONS RESULTING FROM CHANGE IN VEHICLE MASS OR DIFFERENCES IN STABILIZATION SYSTEM RESPONSE CHARACTERISTICS
- 02-LACK OF MEANS TO DEACTIVATE SYSTEMS IN PASSIVE VEHICLE - PARTICULARLY ON RESCUE OF INCAPACITATED CREW

## HAZARD EFFECTS

DAMAGE TO ONE OR BOTH VEHICLES ENOUGH TO IMPAIR RETURN OF EITHER OR BOTH VEHICLES AND CREW

HAZARD NUMBER 1YXX-G501-55

RELATED HAZARD ANALYSIS

-----  
NONE

HAZARD IDENTIFICATION CONCURRENCE

-----  
FUNCTIONAL LEAD -INTERFACE-

SAFETY LEAD W.E.PLAISTED

DISPOSITION

-----  
RESP GRP ACTION DOCUMENTATION  
-----

CHARACTERISTICS OF OTHER SPACE  
ACTIVE SYSTEMS TO BE REVIEWED  
WHEN AVAILABLE AND/OR WHEN  
IDENTIFIED

CLOSURE RATIONALE

-----  
HAZARD IS DELETED AS DOCKING MODULE RELATED HAZARDS ARE NOT  
BEING ADDRESSED.

HA-TRACK

01/27/77 PAGE 1

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT | HZD<br>TRACK | HAZD<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------|--------------|-------------|------------------|---------------|
| 12XX-0501-57              | FLIGHT CONTROLS SYS                 | CA            | CN/CN        | 123         | CONTROLLED       | 101575        |

HAZARD DESCRIPTION

FAILURE OF MDM TO PROVIDE A DISABLE SIGNAL WHEN THE BODY FLAP IS  
BEING DRIVEN

| FLIGHT TEST | X | GROUND TEST         | FERRY FLIGHTS | ORBITAL MISSION       | OTHER |
|-------------|---|---------------------|---------------|-----------------------|-------|
| PRELAUNCH   |   | LIFT OFF THRU ORBIT | ON ORBIT      | DE-ORBIT THRU LANDING | X     |

|  |                      |
|--|----------------------|
| HAZARD GROUP FF LOSS OF FLIGHT CONTROL | RESP ENGR R.F.RAASCH |
|--|----------------------|

RELATED FMEAS

FMEA REQD YES NO

ALT FCS FMEA & CIL SD75-SH-0193 - 12 SEP 75

X

REFERENCES

SD74-SH-0066

HAZARD CAUSES

ONLY ONE MDM (MDM FA-2 PRIME) IS USED AT A TIME TO DRIVE THE  
BODY FLAP.

HAZARD EFFECTS

BODY FLAP DRIVE, IF NOT DISABLED WHEN REQUIRED, COULD DRIVE BODY  
FLAP TO EXTREME POSITION NOT COMPATIBLE WITH FLIGHT PROFILE  
REQUIREMENTS - LOSING VEHICLE AND CREW

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SD77-SH-0001-06

HAZARD NUMBER 1ZXX-0501-57

## RELATED HAZARD ANALYSIS

-----  
NONE

## HAZARD IDENTIFICATION CONCURRENCE

-----  
FUNCTIONAL LEAD -INTERFACE-

SAFETY LEAD W.E.PLAISTED

## DISPOSITION

RESP GRP ACTION DOCUMENTATION

-----  
FOR OV-101, SOFTWARE PACKAGE IS  
DEVELOPED TO DETECT RUNAWAY  
BODY FLAP THROUGH A POSITION HOLD  
LOOP IF MDM CHANNEL LOCKOUT  
OCCURS, ALLOWING EVENTUAL  
SHUTDOWN OF MDM-----  
CHANGE REQUEST  
(SFTWR DES REV)  
CR#1522FOR OV-102, A CREW ACCESSIBLE  
ENGAGE RESET OVERRIDE IS TO BE  
PROVIDED

1L354-400-76-101

## CLOSURE RATIONALE

-----  
THIS HAZARD IS CLOSED BASED ON THE CORRECTIVE ACTION NOTED  
ABOVE.

## HAZARD DISPOSITION CONCURRENCE

-----  
FUNCTIONAL SUPERVISION DEP-GRP DATE SAFETY SUPERVISION DATE  
-----  
-INTERFACE- F.J.ATTAWAYORIGINAL PAGE IS  
OF POOR QUALITY

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| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | HZD<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| IYXX-0502-02-01           | COMM & TRACKING                     | CA                  | CN/CN 123  | CONTROLLED       | 030375        |

## HAZARD DESCRIPTION

FRACTURE OF KU-BAND MSBLS WAVEGUIDE SEGMENTS IN RCS BAY

| FLIGHT TEST<br>PRELAUNCH | GROUND TEST<br>LIFT OFF THRU ORBIT | FERRY FLIGHTS<br>ON ORBIT X | ORBITAL MISSION<br>DE-ORBIT THRU | OTHER<br>LANDING X |
|--------------------------|------------------------------------|-----------------------------|----------------------------------|--------------------|
|                          |                                    |                             |                                  |                    |

HAZARD GROUP CC FIRE &amp; EXPLOSION

RESP.ENGR. R.F.RAASCH

RELATED FMEAS

FMEA REQD YES NO

NONE

X

REFERENCES

ME413-0038, MC481-0067, MC409-0017, V070-7+2004

HAZARD CAUSES

01-BREAKAGE OF WAVEGUIDE IN RCS BAY CAUSING ARCING

HAZARD EFFECTS

SOURCE OF ARCING IN RCS BAY, POSSIBLE FIRE AND EXPLOSION

HAZARD NUMBER 1YXX-0502-02-01

RELATED HAZARD ANALYSES

01-1YXX-0302-05

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD -INTERFACE-

SAFETY LEAD W.E.PLAISTED

DISPOSITIONRESP GRPACTION DOCUMENTATION

01-REROUTE WAVEGUIDE FROM RCS BAY

V070-742004

CLOSURE RATIONALETHIS HAZARD IS CLOSED AS WAVEGUIDE NO LONGER IS IN RCS BAY PER  
V070-742004HAZARD DISPOSITION CONCURRENCEFUNCTIONAL SUPERVISION DEP-GRPDATESAFETY SUPERVISIONDATE

-INTERFACE-

F.J.ATTAWAY

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SD77-SII-0001-06

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | HZD<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 12XX-0502-02              | COMM & TRACKING                     | CA                  | CN/CN 12   | CONTROLLED       | 062074        |

HAZARD DESCRIPTIONCORONA & ARCING ON ORBITER EQUIPMENT

FLIGHT TEST X GROUND TEST X FERRY FLIGHTS ORBITAL MISSION X OTHER  
PRELAUNCH X LIFT OFF THRU ORBIT X ON ORBIT X DE-ORBIT THRU LANDING X

HAZARD GROUP CC FIRE & EXPLOSIONRESP. ENGR R.RAASCHRELATED FMEASFMEA REQD YES NONONEXREFERENCES

MSC-00134 REV A ITEM 19; MSC1 8080 DPS#37

HAZARD CAUSES

01-LEAKAGE OF SEALED PRESSURIZED COMPONENTS/COMPARTMENTS  
02-VACUUM CRITICAL EQUIPMENT VACUUM HOLD CAPABILITY NOT TESTED  
03-EQUIPMENT/MATERIALS OUTGASSING  
04-SHARP POINTS & EDGES IN HIGH INTENSITY ELECTRIC FIELDS

HAZARD EFFECTS

CORONA/ARCING IS SOURCE OF IGNITION IN COMBUSTIBLE AIR PARCEL,  
COULD LEAD TO LOSS OF VEHICLE & PERSONNEL

RELATED HAZARD ANALYSESNONE

HAZARD NUMBER 1ZXX-0502-02

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD CUMMINGS/VARIAN SAFETY LEAD W.E.PLAISTED

| <u>DISPOSITION</u>                | <u>RESP GRP</u> | <u>ACTION DOCUMENTATION</u> |
|-----------------------------------|-----------------|-----------------------------|
| 01-THRU 04-DESIGN AVIONICS SYSTEM | 392-420         | MF0004-002B                 |
| PER REQUIREMENT 45 OF MIL-STD-    | 392-430         |                             |
| 454 AS CALLED OUT IN PARA.        |                 |                             |
| 3.4.9. OF MF-0004-002B            |                 |                             |

CLOSURE RATIONALE

HAZARD IS CLOSED AS THE ORBITER RADIATING SYSTEMS HAVE CORONA  
AND ARCING CONTROLLING DESIGN CONSTRAINTS, AS CALLED OUT IN  
CORRECTIVE ACTION ITEMS ABOVE, INCORPORATED INTO THE SYSTEM DESIGN  
REQUIREMENTS PER MF0004-002B

HAZARD DISPOSITION CONCURRENCE

| <u>FUNCTIONAL SUPERVISION</u> | <u>DEP-GRP</u> | <u>DATE</u> | <u>SAFETY SUPERVISION</u> | <u>DATE</u> |
|-------------------------------|----------------|-------------|---------------------------|-------------|
| F.CUMMINGS/R.VARIAN           | 392-4X0        | 062375      | F.J.ATTAWAY               | 070775      |

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT | H2D<br>TRACK | HAZD<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------|--------------|-------------|------------------|---------------|
| 1YXX-0502-03              | MSBLS WAVEGUIDE                     | CR            | CR/CN        | 2           | IN-WORK          | 112274        |

## HAZARD DESCRIPTION

LEAKAGE OF MSBLS RU-AND WAVE GUIDE THROUGH PRESSURE BULKHEAD  
REDUCES CABIN PRESSURE

FLIGHT TEST    GROUND TEST    FERRY FLIGHTS    ORBITAL MISSION X OTHER  
PRELAUNCH    LIFT OFF THRU CREIT    ON ORBIT X DE-ORBIT THRU LANDING

HAZARD GROUP DD LOSS OF ENVIRONMENT

RESP.ENGR. R.F. RAASCH

RELATED FMLAS

FMEA REQD YES NO

05-2-22004F-2

X

## REFERENCES

AVCO DOCUMENT "CTP NO.004 REV "C" PER DRL ITEM TMD 3(M)"  
HAZARD CAUSES

- 01-RUPTURE OF WAVEGUIDE WALL AND
- 02-RUPTURE OF PRESSURE WINDOW
- 03-LOSS OF PRESSURE SEALS

## HAZARD EFFECTS

LEAKAGE THROUGH AN EQUIVALENT .45 IN-DIA CIRCLE (.159 SQ IN)  
OR GREATER WILL EXCEED LOSS MAKE UP CAPABILITY. MAX WAVEGUIDE  
CROSS SECTION=APPROX.19 SQ IN: LOSS OF MISSION

HAZARD NUMBER 1YXX-0502-00

RELATED HAZARD ANALYSES

-----  
NONE

HAZARD IDENTIFICATION CONCURRENCE

-----  
FUNCTIONAL LEAD R.E.DAVIS

SAFETY LEAD W.E.PLAISTED

DISPOSITION

RESP GRP

ACTION DOCUMENTATION

-----  
C1-VIBRATION & PRESSURE CHECK  
MULTIPLE WAVEGUIDE SEGMENT  
ASSEMBLIES

392-450

AVCO QTP NO.004,  
REV C0200-QUALIFY FEEDTHROUGH FITTING 392-450  
& FITTING-TO-BULKHEAD SEAL USING  
FEEDTHROUGH FITTING AND RI/SU  
PROVIDED SEALAVCO QTP NO. 004,  
REV C

87

SD77-SH-0001-06

ORIGINAL PAGE IS  
OF POOR QUALITY

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | HZD<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1ZXX-0503-02              | DISPLAYS-CONTROLS                   | CR CN/CN            | 3          | CONTROLLED       | 091174        |

## HAZARD DESCRIPTION

CREW ALERTED TO NON-EXISTANT FIRE CONDITION BY FALSE ALARM FROM  
SMOKE DETECTION SUBSYSTEM

FLIGHT TEST X GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER  
PRELAUNCH X LIFT OFF THRU ORBIT X ON ORBIT X DE-ORBIT THRU LANDING X

HAZARD GROUP CC FIRE &amp; EXPLOSION

RESP. ENGR D.K.MC GRAW

## RELATED FMEAS

FMEA REQD YES NO

NONE

X

## REFERENCES

## HAZARD CAUSES

SHORT CIRCUIT IN SMOKE SENSOR

## HAZARD EFFECTS

EMERGENCY FIRE ALARM WOULD CAUSE THE CREW TO IMMEDIATELY  
INVESTIGATE THE CAUSE FOR THE ALARM. PRIOR TO DISCHARGING THE  
FIRE SUPPRESSANT, THE CREW WOULD TRY AND VERIFY THAT  
A FIRE CONDITION ACTUALLY EXISTS. EXCESSIVE FALSE ALARMS MAY  
CAUSE CREW TO LOSE CONFIDENCE IN SYSTEM AND DELAY RESPONSE IN  
REAL EMERGENCY.

## RELATED HAZARD ANALYSES

1ZXX-0602-04-02, 1ZXX-0503-08

HAZARD NUMBER 12XX-0503-02

## HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD B.L.MANN

SAFETY LEAD W.E.PLAISTED

## DISPOSITION

RESP GRP ACTION DOCUMENTATION

PROVIDE SUFFICIENT DESIGN  
FEATURES TO ASSIST CREW IN  
DISCRIMINATING A FALSE ALARM.  
PER MC282-0065 & MC431-0127

389-301

## CLOSURE RATIONALE

AN ALARM FROM A SINGLE SENSOR IN THE AVIONICS BAYS WOULD NOT BE SUFFICIENT FOR A CREWMAN TO DISCHARGE THE FIRE SUPPRESSANT. THE CREW WOULD RESET THE SENSOR AND THEN MAKE A DECISION TO DISABLE THE SENSOR, INVESTIGATE, OR DISCHARGE THE SUPPRESSANT. IF THE FIRE ALARM WAS CAUSED BY A FAULTY SENSOR ON THE FLIGHT DECK OR MID-DECK, THE CREW WOULD REQUIRE SENSORY VERIFICATION BEFORE DISCHARGING THE PORTABLE EXTINGUISHER. IN ADDITION, IF THE LIGHT DOES NOT EXTINGUISH FOR AT LEAST 4-SECONDS ON THE RESET COMMAND, THIS WOULD INDICATE A MALFUNCTION FALSE ALARM. MC282-0065 & MC431-0127 DETAILS THESE DESIGN PROVISIONS

## HAZARD DISPOSITION CONCURRENCE

| FUNCTIONAL SUPERVISION | DEP-GRP | DATE | SAFETY SUPERVISION | DATE   |
|------------------------|---------|------|--------------------|--------|
| O.T.STOLL              | 389-301 |      | F.J.ATTAWAY        | 071075 |

89

SD77-SH-0001-06



| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | H2D<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 12XX-0503-03              | DISPLAYS-CONTROLS                   | CR                  | CN/CN 12   | CONTROLLED       | 091174        |

## HAZARD DESCRIPTION

FAILURE OF C&W SUBSYSTEM TO ALERT CREW OF A MALFUNCTION OR  
OUT-OF-TOLERANCE CONDITION

PRELAUNCH X LIFT OFF THRU ORBIT X ON ORBIT X DE-ORBIT THRU LANDING X  
FLIGHT TEST X GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER

HAZARD GROUP DD LOSS CF/UNSAFE ENVIRONMENT RESP. ENGR D.R.MC GRAW

## RELATED FMEAS

FMEA REQD YES NO

05-3-12305,-12306,-12309,-12310,-12313

X

## REFERENCES

## HAZARD CAUSES

01-FAILURE OF SENSOR,C&W ELECTRONICS UNIT OR STATUS DISPLAY  
02-C&W TONES NOT ON SPEAKER/MICROPHONE NETWORK

## HAZARD EFFECTS

THE CREW WOULD NOT BE ALERTED TO A CONDITION WHICH, IF  
UNCORRECTED, OR CONTINGENCY PLANS ARE NOT IMPLEMENTED, COULD  
LEAD TO A LOSS OF CREW, VEHICLE OR MISSION.

## RELATED HAZARD ANALYSES

12XX-0503-07, 12XX-0503-08, 12XX-0503-09, 12XX-0503-10

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OF POOR QUALITY

HAZARD NUMBER 12XX-0503-13

## HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD R.C.LAVEY

SAFETY LEAD W.C.PLAISTED

## DISPOSITION

RESP GRP ACTION DOCUMENTATION

THE HARDWIRED PRIMARY C&W  
SUBSYSTEM AND THE SOFTWARE  
BACK-UP C&W SATISFY THE  
REDUNDANCY REQUIREMENTS OF  
MC409-0012

392-640

## CLOSURE RATIONALE

01- THE C&W SUBSYS IS BASICALLY A REDUNDANT SUBSYSTEM BECAUSE OF THE BACKUP SM SOFTWARE SUBSYSTEM. HOWEVER THERE ARE CASES WHERE BOTH THE PRIMARY AND BACKUP C&W RECEIVE INPUTS FROM A SINGLE TRANSDUCER. THIS WAS NOTED ON RID 1-44 FROM THE DEL SYSTEM REVIEW OF 021574. THE SINGLE SENSOR CONDITION WAS DISCUSSED AT A SUBSEQUENT TSR AND THE NASA & RI MANAGEMENT DISAPPROVED THE RID RECOMMENDATION ON THE BASIS THAT SINGLE SENSORS ARE ONLY USED IN FO/FB SYSTEMS AND THAT THERE ARE ADDITIONAL SOURCES OF DATA TO ALERT THE CREW OF HAZARDOUS CONDITIONS.

02-C&W TONES ARE DISTRIBUTED THROUGHOUT ORBITER BY AUDIO SYSTEM PER RECENT DESIGN CHANGE (MCR 2165)

## HAZARD DISPOSITION CONCURRENCE

| FUNCTIONAL SUPERVISION | DEP-GRP | DATE   | SAFETY SUPERVISION | DATE   |
|------------------------|---------|--------|--------------------|--------|
| R.Glob                 | 392-640 | 062775 | F.J.ATTAWAY        | 071075 |

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OF POOR QUALITY

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SD 77-SH-0001-06

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | HZD<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1ZXX-0503-04              | DISPLAYS-CONTROLS                   | CR                  | CN/CN 12   | CONTROLLED       | 090674        |

## HAZARD DESCRIPTION

ACCIDENTAL ACTUATION OF PRIMARY FLIGHT CONTROL "RESET" (OV-101)/  
"DISENGAGE" (OV-102) SWITCH WHILE IN BACK-UP FLIGHT CONTROL  
WOULD TRANSFER FROM BACK-UP TO PRIMARY MODE AND WOULD CAUSE  
SUBSEQUENT LOSS OF FLIGHT CONTROL.

| FLIGHT TEST X GROUND TEST | FERRY FLIGHTS                  | ORBITAL MISSION X OTHER |
|---------------------------|--------------------------------|-------------------------|
| PRELAUNCH                 | LIFT OFF THRU ORBIT X ON ORBIT | DE-ORBIT THRU LANDING X |

| HAZARD GROUP | FF LOSS OF FLIGHT CONTROL | RESP. ENGR D.R.MC GRAW |
|--------------|---------------------------|------------------------|
|              |                           |                        |

## RELATED FMEAS

FMEA REQD YES NO

NONE

X

## REFERENCES

## HAZARD CAUSES

THERE IS NO SWITCH GUARD FOR "RESET" (OV-101)/"DISENGAGE" (OV-102) SWITCH OR SOFTWARE LOGIC TO PREVENT ACCIDENTAL TRANSFER BACK INTO PRIMARY FLIGHT MODE DURING MISSION

## HAZARD EFFECTS

FLIGHT CONTROL SYSTEM NOT DESIGNED TO SAFELY TRANSFER FROM BACK-UP TO PRIMARY FLIGHT CONTROL MODE.

HAZARD NUMBER 12XX-0503-04

RELATED HAZARD ANALYSES

1AXX-0503-05, 1AXX-0503-11

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD E.MURPHY

SAFETY LEAD W.E.PLAISTED

DISPOSITIONRESP GRP ACTION DOCUMENTATION

A SWITCH GUARD IS RECOMMENDED FOR  
"RESET"(OV-101)/"DISENGAGE"(OV-  
102) SWITCH TO PREVENT INADVERTENT  
ACTUATION

392-640

CLOSURE RATIONALE

SWITCH GUARDS HAVE BEEN PROVIDED AS REQUIRED, THEREFORE THIS  
HAZARD IS CLOSED.

HAZARD DISPOSITION CONCURRENCE

| <u>FUNCTIONAL SUPERVISION</u> | <u>DEP-GRP</u> | <u>DATE</u> | <u>SAFETY SUPERVISION</u> | <u>DATE</u> |
|-------------------------------|----------------|-------------|---------------------------|-------------|
| R.GIBB                        | 392-640        | 062775      | F.J.ATTAWAY               | 070775      |

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | HZD<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1ZXX-0503--05             | DISPLAYS-CONTRCLS                   | CR                  | LN/CN 12   | CONTROLLED       | 090674        |

## HAZARD DESCRIPTION

EXISTING C&W PARAMETER SELECTION FOR PRIMARY FLIGHT CONTROL  
FAILURE MAY NOT BE RELIABLE OR SUFFICIENT FOR CREWMAN TO SWITCH  
TO BACK-UP FLIGHT CONTROL MODE

|               |                       |               |                         |       |
|---------------|-----------------------|---------------|-------------------------|-------|
| FLIGHT TEST X | GROUND TEST           | FERRY FLIGHTS | ORBITAL MISSION X       | OTHER |
| PRELAUNCH     | LIFT OFF THRU ORBIT X | ON ORBIT      | DE-ORBIT THRU LANDING X |       |

|  |                        |
|--|------------------------|
| HAZARD GROUP FF LOSS OF FLIGHT CONTROL | RESP. ENGR D.R.MC GRAW |
|--|------------------------|

## RELATED FMEAS

NONE

FMEA REQD YES NO

X

## REFERENCES

## HAZARD CAUSES

THIS HA ASSUMES THAT A GENERIC SOFTWARE ERROR EXISTS IN ALL THE  
PRIMARY FLIGHT CONTROL COMPUTERS AND THAT THIS ERROR WAS NOT  
DETECTED DURING DEBUGGING TESTS PRIOR TO THE MISSION

## HAZARD EFFECTS

INSUFFICIENT &/OR UNRELIABLE COMPUTER FAILURE DISPLAY DATA FOR  
CREWMAN MAY CONFUSE OR DELAY CREW RESPONSE DURING TIME  
CRITICAL PERIOD

HAZARD NUMBER 1ZXX-G503-05

## RELATED HAZARD ANALYSES

1AXX-0503-04, 1AXX-0503-05, 1ZXX-0503-09, 1XAA-G503-11  
1AXX-0507-03

## HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD M.STRETTON

SAFETY LEAD W.E.PLAISTED

## DISPOSITION

RESP GRP ACTION DOCUMENTATION

PROVIDE ADEQUATE C&W PARAMETERS  
AND DEDICATED DISPLAYS TO ALERT  
CREW TO FLIGHT CONTROL ANOMALIES

382-400

## CLOSURE RATIONALE

GPC COMPUTER C&W LIGHT MATRIX EXISTS FOR ALL 5 COMPUTERS. THESE FAILURE SIGNALS WILL BE BASED ON VOTING LOGIC CIRCUITRY AND/OR BITE. THERE ARE SEVERAL OTHER GNEC C&W PARAMETERS WHICH MAY PROVIDE AN INDIRECT INDICATION OF COMPUTER FAILURE. THE DEDICATED FLIGHT INSTRUMENTS SUCH AS ADI, HSI AND AVVI CAN BE USED TO DETERMINE IF THERE ARE FLIGHT CONTROL ANOMALIES. IN ADDITION, PHYSICAL CUES CAN BE USED BY THE CREW TO ASSESS THE FLIGHT CONTROL STATUS, THEREFORE THIS HAZARD IS CLOSED.

## HAZARD DISPOSITION CONCURRENCE

| FUNCTIONAL SUPERVISION | DEP-GRP | DATE   | SAFETY SUPERVISION | DATE   |
|------------------------|---------|--------|--------------------|--------|
| G.W.LINDEWALL          | 382-400 | 062375 | F.J.ATTAWAY        | 071075 |

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | H2D<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1ZXX-0503-07              | DISPLAYS-CONTROLS                   | CR                  | CN/CN 3    | CONTROLLED       | 091174        |

## HAZARD DESCRIPTION

FALSE ALARM FROM C&W SUBSYSTEM INDICATES AN OUT-OF-TOLERANCE OR  
MALFUNCTION CONDITION

FLIGHT TEST X GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER  
PRELAUNCH X LIFT OFF THRU ORBIT X ON ORBIT X DE-ORBIT THRU LANDING X

HAZARD GROUP DD LOSS OF/UNSAFE ENVIRONMENT RESP. ENGR D.R.MC GRAW

## RELATED FMEAS

NONE

FMEA REQD YES NO

X

## REFERENCES

## HAZARD CAUSES

OPEN OR SHORT CIRCUIT IN C&W ELECTRONICS OR STATUS DISPLAY  
AND TRANSIENT IN SYSTEM OR DATA BUS

## HAZARD EFFECTS

THE C&W ALARM WOULD PERTURB CREW ACTIVITIES AND WOULD REQUIRE  
THEM TO ATTEMPT TO VERIFY THE CONDITION. FALSE ALARMS WOULD CAUSE  
CREW TO LOSE CONFIDENCE IN C&W SUBSYSTEM AND MAY DEGRADE CREW  
RESPONSE TIME IN REAL EMERGENCY

## RELATED HAZARD ANALYSES

1ZXX-0503-02, 1ZXX-0503-06

1ZXX-0503-07

## HAZARD IDENTIFICATION CONCURRENCE

-----  
FUNCTIONAL LEAD D.SMITH

SAFETY LEAD W.E.PLAISTED

## DISPOSITION

RESP GRP ACTION DOCUMENTATION

-----  
PROVIDE TRANSIENT PROTECTION  
DESIGN FEATURES TO MINIMIZE  
LIKELIHOOD OF FALSE ALARMS,  
PROVIDE INHIBIT FEATURE TO  
SUPPRESS FALSE ALARM AND  
PARAMETER LIMIT CHANGE  
CAPABILITY PER MC409-0012

392-640

## CLOSURE RATIONALE

-----  
THE ABOVE CORRECTIVE ACTION ITEMS HAVE BEEN IMPLEMENTED INTO  
THE SUBSYSTEM DESIGN

## HAZARD DISPOSITION CONCURRENCE

-----  
FUNCTIONAL SUPERVISION DEP-GRP

DATE

SAFETY SUPERVISION

DATE

R.GIBB

392-640

F.J.ATTAWAY

071075



HA-TRACK

01/27/77 PAGE 1

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | H2O<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1ZXX-0503-08              | DISPLAYS-CONTROLS                   | CR                  | 12         | DELETED          | 091174        |

HAZARD DESCRIPTION

SMOKE DETECTION SUBSYSTEM FAILS TO DETECT INCIPIENT FIRE  
(THIS HAZARD HAS BEEN DELETED AS IT IS REDUNDANT WITH HAZARDS  
1AXX-0602-04 AND 1YXX-0602-04-08)

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | HZD<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 12XX-0503-09              | DISPLAYS-CONTROLS                   | CR                  | CN/CN 12   | CONTROLLED       | 091174        |

## HAZARD DESCRIPTION

PRIMARY C&W EQUIPMENT FAILS TO ALERT CREW OF FAILURE CONDITION  
AND BACK-UP C&W DOES NOT IMMEDIATELY ANNUNCIATE CONDITION

FLIGHT TEST X GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER  
PRELAUNCH X LIFT OFF THRU ORBIT X ON ORBIT X DE-ORBIT THRU LANDING X

HAZARD GROUP DD LOSS OF/UNSAFE/ENVIRONMENT RESP. ENGR D.R.MC GRAW

## RELATED FMEAS

FMEA REQD YES NO

## REFERENCES

## HAZARD CAUSES

BACK-UP C&W DATA IS FROM PMS. SAMPLING RATE COULD CAUSE A 30 SEC.  
DELAY FOR SIGNAL TO C&W PANEL TO ALERT CREW.

## HAZARD EFFECTS

A 30 SEC. DELAY IN ALERTING CREW OF ANOMALY COULD AFFECT  
CREW CORRECTIVE ACTION. NOTE: BY DEFINITION, ALL C&W  
PARAMETERS REQUIRE IMMEDIATE CREW ATTENTION.

## RELATED HAZARD ANALYSES

1AXX-0503-11

HAZARD NUMBER 1ZXX-0503-09

HAZARD IDENTIFICATION CONCURRENCEFUNCTIONAL LEAD J.T.KLUTHSAFETY LEAD W.E.PLASITEDDISPOSITIONRESP GRP ACTION DOCUMENTATION

THE ORIGINAL DELAY CAUSED BY  
THE SM FUNCTION WAS DUE TO BOTH  
THE SAMPLING RATE AND A TRANSIENT  
FILTER VALUE. THE NEW DELAY WILL BE  
NO GREATER THAN THREE SECONDS  
FOR ANY CGW PARAMETER

382-510

CLOSURE RATIONALE

THE 30-SECOND DELAY HAS BEEN REDUCED TO THREE SECONDS AND IS  
DOCUMENTED IN FSSK SD74-SH-02958

HAZARD DISPOSITION CONCURRENCEFUNCTIONAL SUPERVISION DEP-GRPDATESAFETY SUPERVISIONDATEA.HARRIS382-510F.J.ATTAWAY022676

100

SD77-SH-0001-06

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | HZO<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 12XX-0503-10              | DISPLAYS-CONTROLS                   | CR                  | CN/CN 12   | CONTROLLED       | 091174        |

## HAZARD DESCRIPTION

FAILURE TO ALERT CREW OF HAZARDOUS CONDITION ON ORBITER FROM C&W  
BECAUSE OF BUS FAILURE

FLIGHT TEST X GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER  
PRELAUNCH X LIFT OFF THRU ORBIT X ON ORBIT X DL-ORBIT THRU LANDING X

HAZARD GROUP DD LOSS OF/UNSAFE ENVIRONMENT RESP. ENGR D.R.MC GRAW

## RELATED FMEAS

NONE

## FMEA REQD YES NO

X

## REFERENCES

## HAZARD CAUSES

LOSS OF ESSENTIAL POWER BUS SEGMENT

## HAZARD EFFECTS

LOSS OF BUS DURING CRITICAL MISSION PHASE RESULTS IN LOSS OF C&W  
DATA FOR BOTH PRIMARY AND BACK-UP C&W. HAZARD MAY DEVELOP WHICH  
REQUIRES IMMEDIATE CREW ALERT AND CORRECTIVE ACTION.

## RELATED HAZARD ANALYSES

12XX-0506-10, 12XX-0503-03

HAZARD NUMBER 12XX-C503-10

HAZARD IDENTIFICATION CONCURRENCE  
-----

FUNCTIONAL LEAD D.SMITH

SAFETY LEAD W.E.PLAISTED

DISPOSITION  
-----RESP GRP ACTION DOCUMENTATION  
-----PROVIDE POWER REDUNDANCY IN C&W  
ELECTRONICS AND C&W FAILURE  
ANNUNCIATION WITH AUXILIARY  
POWER SUPPLY PER MC409-0012

392-640

CLOSURE RATIONALE  
-----TWO POWER SUPPLIES ARE ACTIVE IN THE C&W ELECTRONICS  
THEREBY ASSURING ANNUNCIATION. IN ADDITION, THE C&W IS REDUNDANT  
BECAUSE OF THE PARALLEL HARDWARE AND SOFTWARE BACK-UP INPUTS.  
REF: MC409-0012. CLOSURE OF THIS HAZARD IS ALSO JUSTIFIED ON THE  
BASIS OF THE REQUIREMENTS IN THE CERTIFICATION PLAN:SD74-SH-0045.HAZARD DISPOSITION CONCURRENCE  
-----

FUNCTIONAL SUPERVISION DEP-GRP

DATE

SAFETY SUPERVISION

DATE

R.GIBB

392-640

F.J.ATTAWAY

071075

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | H2D<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1ZXX-0503-11              | DISPLAYS-CONTROLS                   | CR                  | CN/CN 12   | CONTROLLED       | 091174        |

HAZARD DESCRIPTION

C&W SUBSYSTEM INDICATES LOSS OF PRIMARY FLIGHT CONTROL SYSTEM DUE TO FAILURE OF ALL PRIMARY FLIGHT CONTROL COMPUTERS. INSUFFICIENT TIME FOR CREW TO SWITCH TO BACK-UP FLIGHT CONTROL MODE.

| FLIGHT TEST X | GROUND TEST           | FEKKY FLIGHTS | ORBITAL MISSION X       | OTHER |
|---------------|-----------------------|---------------|-------------------------|-------|
| PRELAUNCH     | LIFT OFF THRU ORBIT X | ON ORBIT      | DE-ORBIT THRU LANDING X |       |

|  |                        |
|--|------------------------|
| HAZARD GROUP FF LOSS OF FLIGHT CONTROL | RESP. ENGR D.R.MC GRAW |
|--|------------------------|

RELATED FMEASFMEA REQD YES NO05-8-BFCS01 THRU 05-8-BFCS16

X

REFERENCESHAZARD CAUSES

THIS HA ASSUMES THAT A GENERIC SOFTWARE ERROR EXISTS IN ALL THE PRIMARY FLIGHT CONTROL COMPUTERS AND THAT THIS ERROR WAS NOT DETECTED DURING DEBUGGING TESTS PRIOR TO THE MISSION.

HAZARD EFFECTS

A CREWMAN HAS A RANGE OF RESPONSE TIMES TO MANUALLY SWITCH FROM PRIMARY TO BACK-UP CONTROL MODE FROM 2.1 SECONDS AT 8000 FT. OR HIGHER, TO .4 SECONDS AT APPROXIMATELY 200 FT. FAILURE TO MANUALLY SWITCH MODES WITHIN THESE TIME CONSTRAINTS MAY RESULT IN LOSS OF THE VEHICLE

HAZARD NUMBER 12XX-0503-11

RELATED HAZARD ANALYSES

1AXX-0503-05, 12XX-0503-09

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD M.STRETTON

SAFETY LEAD W.E.PLAISTED

DISPOSITIONRESP GRP ACTION DOCUMENTATION

PROVIDE ADEQUATE DISPLAYS TO  
INDICATE FAILURE IN PRIMARY  
FLIGHT CONTROL SYSTEM. PROVIDE  
EASILY ACCESSIBLE LOCATION FOR  
BACKUP FLIGHT CONTROL ENGAGE  
SWITCH. PERFORM MAN IN LOOP  
SIMULATION TESTS TO ASSESS  
CREW RESPONSE TIMES.

382-400

CLOSURE RATIONALE

HAZARD IS CLOSED BASED ON COMPLIANCE WITH ABOVE CORRECTIVE  
ACTION. SIMULATION TESTS DEMONSTRATED ADEQUACY OF EXISTING  
DESIGN FOR INITIATION OF BACK-UP FLIGHT CONTROL SYSTEM.

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | H2D<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 12XX-0503-12              | DISPLAYS-CONTROLS                   | CR                  | CN/CN 12   | CONTROLLED       | 092674        |

## HAZARD DESCRIPTION

LOSS OF FLIGHT CONTROL STABILITY AND CREWMAN ELECTS TO DOWNMODE  
IN PRIMARY RATHER THAN TRANSFER TO BACK-UP FLIGHT CONTROL SYSTEM

| FLIGHT TESTX<br>PRELAUNCH | GROUND TEST<br>LIFT OFF THRU ORBIT | FERRY FLIGHTS<br>X ON ORBIT | ORBITAL MISSION X<br>DE-ORBIT THRU LANDING X | OTHER |
|---------------------------|------------------------------------|-----------------------------|--|-------|
|---------------------------|------------------------------------|-----------------------------|--|-------|

|  |                        |
|--|------------------------|
| HAZARD GROUP FF LOSS OF FLIGHT CONTROL | RESP. ENGR D.R.MC GRAW |
|--|------------------------|

## RELATED FMEAS

NONE

FMEA REQU YES NO

X

## REFERENCES

## HAZARD CAUSES

SOFTWARE ERROR IN COMPUTER PROGRAM AFFECTING ALL FOUR PFCS GNEC  
COMPUTERS

## HAZARD EFFECTS

VALUABLE TIME IS SPENT IN DOWNMODING BUT ALL PFCS MODES ARE  
INOPERATIVE AND BY THE TIME CREWMAN ENGAGES BACK-UP SYSTEM,  
FLIGHT CONTROL HAS DEGRADED TO THE POINT OF NOT BEING  
RECOVERABLE



HAZARD NUMBER 1ZXX-0503-12

RELATED HAZARD ANALYSES

-----  
1AXX-0503-04, 1AXX-0503-05, 1AXX-0503-11, 1AXX-0505-01,  
1AXX-0507-03

HAZARD IDENTIFICATION CONCURRENCE

-----  
FUNCTIONAL LEAD M. STRETTON

SAFETY LEAD W.E.PLAISTED

DISPOSITION

RESP GRP ACTION DOCUMENTATION

-----  
SIMULATION TESTS ARE PLANNED TO  
ESTABLISH CRITERIA FOR BACK-UP  
FLIGHT CONTROL ENGAGEMENT  
DECISION-MAKING. SIMULATION STUDY  
WILL ADDRESS INITIATION  
DECISIONS, DOWNMODING AND SYSTEM  
RESPONSE TIMES AND VEHICLE  
RECOVERABILITY CONSTRAINTS.  
THESE PLANS ARE DOCUMENTED IN  
SD74-SH-0246 AND SD74-SH-0137

-----  
382-400

CLOSURE RATIONALE

-----  
SIMULATION TESTS INDICATED THAT CREW JUDGEMENT MUST BE EXERCISED  
IN DECIDING WHETHER TO DOWNMODE IN PFCS OR TO IMMEDIATELY EN-  
GAGE BFCS. AT HIGH ALTITUDE AND WITH MINOR STABILITY PROBLEMS,  
IT MAY BE POSSIBLE TO DOWNMODE BUT THIS MAY NOT BE TRUE AT LOWER  
ALTITUDES OR WITH MAJOR FLIGHT STABILITY PROBLEMS. THE TEST  
RESULTS HAVE BEEN TRANSMITTED TO JSC FOR CREW FLIGHT TRAINING;  
THEREFORE THIS HAZARD IS CLOSED.

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | HZL<br>CAI | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 12XX-0503-13              | DISPLAYS-CONTROLS                   | OR CN/CN            | 12         | CONTROLLED       | 092674        |

## HAZARD DESCRIPTION

MECHANICAL FAILURE IN ROTATION HAND CONTROLLER RESULTS IN LOSS OF FLIGHT CONTROL

FLIGHT TEST X GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER  
PRELAUNCH LIFT OFF THRU ORBIT X ON ORBIT DE-ORBIT THRU LANDING X

HAZARD GROUP FF LOSS OF FLIGHT CONTROL RESP. ENGR D.R.MC GRAW

## RELATED FMEAS

FMEA REQD YES NO

05-1-FC3042-1

X

## REFERENCES

## HAZARD CAUSES

- 01-PHYSICAL JAMMING OF HAND CONTROLLER
- 02-MECHANICAL LINKAGE FAILURE OF HAND CONTROLLER

## HAZARD EFFECTS

WORST CASE SITUATION IS FAILURE IN HARDOVER POSITION AND HIGH ROLL RATES RESULTING IN LOSS OF FLIGHT CONTROL.

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OF POOR QUALITY

HAZARD NUMBER 12XX-0503-13

RELATED HAZARD ANALYSIS

1YXX-0503-17

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD R.F.WULFE

SAFETY LEAD W.E.PLAISTED

DISPOSITION

RESP GRP ACTION DOCUMENTATION

PROVIDE SAFETY FEATURES SO THAT  
CREW CAN DISABLE FAILED HAND  
CONTROLLER AND SWITCH TO  
REDUNDANT CONTROLLER

392-210

CLOSURE RATIONALE

A HAND CONTROLLER DISABLE SWITCH HAS BEEN PROVIDED FOR EACH  
CONTROLLER ON THE FLIGHT PANEL. THE TOGGLE SWITCH IS WITHIN  
EASY REACH OF EACH CREWMAN SO THAT IF ONE CONTROLLER JAMMED, ONE  
CREWMAN CAN DISABLE IT AND THE OTHER CREWMAN CAN TAKE OVER  
CONTROL WITH THE REDUNDANT STICK. REF:VL70-730101

HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP

DATE

SAFETY SUPERVISION

DATE

R.E.ANTLETT

392-210

F.J.ATTAWAY

071075

ORIGINAL PAGE IS  
OF POOR QUALITY

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SD77-SH-0001-06

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | H2D<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| LYXX-0500-14              | DISPLAYS-CONTROLS                   | CR                  | CN/CN 3    | CONTROLLED       | 110474        |

## HAZARD DESCRIPTION

ERRONEOUS OUTPUT FROM RAPID DELTA P EQUIPMENT ACTIVATES EMERGENCY ALARM

FLIGHT TEST GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER  
PRELAUNCH LIFT OFF THRU CREIT X ON ORBIT X DE-ORBIT THRU LANDING X

HAZARD GROUP DD LOSS OF/UNSAFE ENVIRONMENT RESP. ENGR. D.R. MCGRAW

## RELATED FMEAS

FMEA REQD YES NO

CS-3-12305,-12306,-12309,-12310,-12313

X

## REFERENCES

NONE

## HAZARD CAUSES

SHORT CIRCUIT IN SENSOR, ELECTRONICS PACKAGE OR DISPLAY UNIT

## HAZARD EFFECTS

THE EMERGENCY ALARM WOULD PERTURB CREW ACTIVITIES AND REQUIRE THEM TO IMMEDIATELY INVESTIGATE THE CAUSE OF THE ALARM. UNDER WORST CASE CONDITIONS, THE CREW MAY INITIATE PRELIMINARY ABORT PROCEDURES. FALSE EMERGENCY ALARM(S) MIGHT CAUSE CREW TO LOSE CONFIDENCE IN WARNING SYSTEM AND RESULT IN DELAY IN EMERGENCY

109

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ORIGINAL PAGE IS  
OF POOR QUALITY

HAZARD NUMBER 1YXX-0503-14

RELATED HAZARD ANALYSES

-----

1YXX-0503-15

HAZARD IDENTIFICATION CONCURRENCE

-----

FUNCTIONAL LEAD J.M. WADA

SAFETY LEAD W.E. PLAISTED

DISPOSITION

-----

RESP GRP

-----

ACTION DOCUMENTATION

-----

PROVIDE DEDICATED CABIN PRESSURE  
METER TO VERIFY CONDITION.  
PROVIDE OTHER C&W PARAMETERS  
WHICH CAN BE USED TO VERIFY THE  
CONDITION, I.E., TOTAL CABIN  
PRESSURE, PO2 AND FLOW RATES.

389-501

CLOSURE RATIONALE

-----

THE ABOVE DEDICATED METERS AND C&W PARAMETERS HAVE BEEN IMPL-  
MENTED IN THE VEHICLE DESIGN. THESE BACKUP OR SECONDARY  
SOURCES OF DATA SHOULD PRECLUDE ANY DETRIMENTAL EFFECTS FROM  
THIS HAZARD. THEREFORE, THIS HAZARD IS CLOSED.

ORIGINAL PAGE IS  
OF POOR QUALITY

110

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| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>1 11 TRACK CAT | H2L<br>HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|-------------------------|-------------------------|---------------|
| 1YXX-0503-15              | DISPLAYS-CONTROLS                   | CR                      | CR/CR 012 CONTROLLED    | 110474        |

## HAZARD DESCRIPTION

EXTERNAL LEAKAGE FROM CREW CABIN AND RAPID DELTA PRESSURE  
DETECTION EQUIPMENT FAILS TO ALERT CREW BY EMERGENCY ALARM

FLIGHT TEST GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER  
PRELAUNCH LIFT OFF THRU ORBIT X ON ORBIT X DE-ORBIT THRU LANDING X

HAZARD GROUP DD LOSS OF/UNSAFE ENVIRONMENT RFSP. ENGR J.K.MC GRAW

## RELATED FMEAS

FMEA REQD YES NO

05-3-12305,-12306,-12309,-12310,-12313

X

## REFERENCES

NONE

## HAZARD CAUSES

OPEN OR SHORT CIRCUIT IN SENSOR, ELECTRONICS PACKAGE OR DISPLAY  
UNIT. NOTE: THERE IS ONLY A SINGLE RAPID DELTA P MEASUREMENT FOR  
THE CAUTION AND WARNING SYSTEM

## HAZARD EFFECTS

AN UNDETECTED AND/OR UNCORRECTED LOSS OF CABIN AIR COULD RESULT  
IN UNNECESSARY LOSS OF CONSUMABLES WHICH MIGHT ENDANGER CREW

111

SD77-SH-0001-06

ORIGINAL PAGE IS  
OF POOR QUALITY

HAZARD NUMBER 1YXX-0503-15

## RELATED HAZARD ANALYSES

-----  
1YXX-0503-14

## HAZARD IDENTIFICATION CONCURRENCE

-----  
FUNCTIONAL LEAD J.M.WADA

SAFETY LEAD W.E.PLAISTED

## DISPOSITION

-----  
RESP GRP ACTION DOCUMENTATION-----  
A REDUNDANT RAPID DELTA PRESSURE  
TRANSDUCER IS RECOMMENDED AS AN  
"OR" INPUT TO EXISTING C&W LIGHT

385-301

## CLOSURE RATIONALE

-----  
A REDUNDANT DELTA PRESSURE TRANSDUCER IS NOT REQUIRED AS THERE  
ARE OTHER C&W PARAMETERS WHICH WOULD ALERT CREW OF EXTERNAL  
LEAKAGE. THESE ARE TOTAL CABIN PRESSURE, PPO2 AND O2/N2 FLOW  
RATES. THERE ARE ALSO DEDICATED METERS FOR ALL THESE PARAMETERS  
ON THE MAIN FLIGHT PANEL.ORIGINAL PAGE IS  
OF POOR QUALITY

SD 77-SH-0001-06

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT | H/D<br>TRACK | HAZARD<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------|--------------|---------------|------------------|---------------|
| 1YXX-0503-16              | DISPLAYS-CONTROLS                   | CK            | CN/CN        | 012           | CONTROLLED       | 110674        |

HAZARD DESCRIPTION

GROUND STATION DETECTS IMPENDING OR ACTUAL HAZARDOUS CONDITION  
FOR ORBITER BUT ORBITER CREW IS IN SLEEP MODE

| FLIGHT TEST | GROUND TEST         | FERRY FLIGHTS | ORBITAL MISSION | X                     | OTHER |
|-------------|---------------------|---------------|-----------------|-----------------------|-------|
| PRELAUNCH   | LIFT OFF THRU ORBIT | ON ORBIT      | X               | DE-ORBIT THRU LANDING |       |

HAZARD GROUP DD UNSAFE ENVIRONMENTRESP. ENGR D.R.MC GRAWRELATED FMEASFMEA REQD YES NO

NONE

X

REFERENCES

NONE

HAZARD CAUSES

NO PROVISION AVAILABLE FOR GROUND STATION TO SEND UPLINK COMMAND  
FOR C&W ALARM TO ALERT CREW

HAZARD EFFECTS

CREW IN SLEEP MODE WOULD NOT BE ALERTED TO HAZARDOUS CONDITION

RELATED HAZARD ANALYSES

NONE



HAZARD NUMBER 1YXX-0503-16

HAZARD IDENTIFICATION CONCURRENCEFUNCTIONAL LEAD R.C.LAVEYSAFETY LEAD W.E.PLAISTEDDISPOSITIONRESP GRP ACTION DOCUMENTATION

PROVIDE CAPABILITY FOR GROUND  
COMMAND TO ACTIVATE C&W LIGHT AND  
AURAL ALARM

392-310

CLOSURE RATIONALE

THE SPEAKER BOXES CAN BE USED TO ANNUNCIATE A VOICE COMMAND FROM THE GROUND TO AWAKEN THE CREW AND APPRISE THEM OF ANY HAZARDOUS CONDITIONS. IN ADDITION, THE ON-BOARD WARNING ALARMS, IE, EMERGENCY, C&W, AND SM CREW ALERT, SHOULD BE ADEQUATE TO ALERT THE CREW OF HAZARDS.

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | HZD<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1YXX-0503-17              | DISPLAYS-CONTROLS                   | CR                  | CN/CN 012  | CONTROLLED       | 110674        |

## HAZARD DESCRIPTION

IMPACT OF ORBITER WITH PAYLOAD BECAUSE OF FAILED TRANSLATION OR  
ROTATION HAND CONTROLLER

FLIGHT TEST    GROUND TEST    FERRY FLIGHTS    ORBITAL MISSION X OTHER  
PRELAUNCH    LIFT OFF THRU ORBIT    ON ORBIT X DE-ORBIT THRU LANDING

HAZARD GROUP BB COLLISION/IMPACT

RESP. ENGR D.R.MC GRAW

RELATED FMEAS

FMEA REQD YES NO

05-1-FC3042-1

X

REFERENCES

NONE

HAZARD CAUSES

01-PHYSICAL JAMMING OF HAND CONTROLLER  
02-MECHANICAL LINKAGE FAILURE OF HAND CONTROLLER

HAZARD EFFECTS

A FAILED HAND CONTROLLER IN A PAYLOAD RETRIEVAL MODE COULD CAUSE  
CONTINUOUS THRUST FROM A THRUSTER AND SUBSEQUENT IMPACT DAMAGE TO  
THE ORBITER AND/OR PAYLOAD

115

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OF POOR QUALITY

HAZARD NUMBER 1YXX-0503-17

## RELATED HAZARD ANALYSES

1LXX-0503-15

## HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD R.F.WULFE

SAFETY LEAD W.E.PLAISTED

## DISPOSITION

RESP GRP ACTION DOCUMENTATION

RECOMMEND PROVISION IN SOFTWARE  
LOGIC TO PERMIT OVERRIDE OF  
JAMMED HAND CONTROLLER OR TOGGLE  
SWITCH TO DISABLE UNIT

## CLOSURE RATIONALE

POWER CONTROL SWITCHES HAVE BEEN PROVIDED TO THE FORWARD AND AFT  
FLIGHT STATIONS. THESE TOGGLE SWITCHES CAN BE USED TO DISABLE  
A HAND CONTROLLER

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OF POOR QUALITY

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| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | HZD<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1YXX-0503-18              | DISPLAYS-CONTROLS                   | CR                  | CN/CN 12   | CONTROLLED       | 022875        |

## HAZARD DESCRIPTION

FAILURE OF PRESSURE TRANSDUCER IN AN OMS ENGINE PRESSURE CHAMBER MAY RESULT IN FAILURE TO ENERGIZE THE C&W LIGHT AND ALERT THE CREW OF AN OMS ENGINE OUT SITUATION WHICH IS AN ABORT CONDITION.

| FLIGHT TEST<br>PRELAUNCH | GROUND TEST<br>LIFT OFF THRU ORBIT | FERRY FLIGHTS<br>X ON ORBIT | ORBITAL MISSION<br>DE-ORBIT THRU LANDING | X OTHER |
|--------------------------|------------------------------------|-----------------------------|--|---------|
|                          |                                    |                             |  |         |

HAZARD GROUP FF LOSS OF FLIGHT CONTROL

RESP. ENGR. D.R. MCGRAW

## RELATED FMEAS

FMEA REQD YES NO

NONE

X

## REFERENCES

NONE

## HAZARD CAUSES

THERE IS ONLY A SINGLE PRESSURE TRANSDUCER IN EACH OMS PRESSURE CHAMBER. THERE ARE NO SPECIFIC OMS ENGINE OUT LIGHTS. IN ADDITION THERE IS NO DIRECT OMS ENGINE OUT PARAMETER CN THE C&W.

## HAZARD EFFECTS

CREW RESPONSE MAY BE DELAYED TO AN ABORT CONDITION. CREW RESPONSE MAY BE TIME-CRITICAL AT MODE BOUNDARY PHASE OF MISSION.

HAZARD NUMBER 1YXX-0503-18

RELATED HAZARD ANALYSES1YXX-0503-19HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD D.R. HAFNER

SAFETY LEAD W.E. PLAISTED

DISPOSITIONRESP GRP ACTION DOCUMENTATION

PROVIDE REDUNDANT OMS CHAMBER  
PRESSURE SENSORS OR PROVIDE ADDI-  
TIONAL DATA INPUT SUCH AS AN  
ACCELEROMETER READING TO  
SOFTWARE PROGRAM TO ASSESS OMS  
ENGINE FAILURE

390-700

CLOSURE RATIONALE

REDUNDANT ACCELERATION INPUTS ARE USED BY SOFTWARE TO DETECT  
OMS ENGINE OUT CONDITION. THEREFORE THIS HAZARD IS CLOSED.

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | H2D<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1YXX-0503-19              | DISPLAYS-CONTRCLS                   | CR                  | CN/CN 12   | CONTROLLED       | 022875        |

## HAZARD DESCRIPTION

IF AN ABORT LITE COMES "ON", THERE MAY NOT BE SUFFICIENT TIME TO DETECT THE SPECIFIC CAUSE THAT TRIGGERED THE ALARM AND TO VERIFY THE CONDITION

| FLIGHT TEST<br>PRELAUNCH | GROUND TEST<br>LIFT OFF THRU ORBIT | FERRY FLIGHTS<br>X ON ORBIT | ORBITAL MISSION<br>DE-ORBIT THRU LANDING | X OTHER |
|--------------------------|------------------------------------|-----------------------------|--|---------|
|--------------------------|------------------------------------|-----------------------------|--|---------|

HAZARD GROUP FF LOSS OF FLIGHT CONTROL

RESP.ENGR. D.R. MCGRAW

## RELATED FMEAS

FMEA REQD YES NO

NONE

X

## REFERENCES

NONE

## HAZARD CAUSES

THERE ARE NO PROVISIONS TO QUICKLY DISPLAY TO THE CREW ALL THE INFORMATION NECESSARY TO IDENTIFY AND VERIFY THE ABORT CONDITION. ALL OF THE ABORT PARAMETERS ARE NOT DISPLAYED ON C&W PANEL.

## HAZARD EFFECTS

A DELAY IN IDENTIFYING AND VERIFYING AN ABORT CONDITION COULD AFFECT CREW RESPONSE IN TIME-CRITICAL ABORT SITUATIONS.

HAZARD NUMBER 1YXX-0503-19

RELATED HAZARD ANALYSES

1YXX-0503-18, 1YXX-0503-20

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD D.R. HAFNER

SAFETY LEAD W.E. PLAISTED

DISPOSITIONRESP GRP ACTION DOCUMENTATIONPROVIDE SUFFICIENT DISPLAYS ON  
FLIGHT PANEL SO THAT CREW CAN  
QUICKLY VERIFY ABORT CONDITION

390-700

NOTE: MCR 2030 HAS BEEN RELEASED  
AND THERE IS A REQUIREMENT TO PRO-  
VIDE ADEQUATE DEDICATED AND SHARED  
METERS, AND CRT DISPLAYS TO  
ALLOW CREW ABORT VERIFICATIONCLOSURE RATIONALETHE ABORT LITE IS ONLY AN ADVISORY DISPLAY WHICH IS TRIGGERED  
BY AN UPLINK GROUND COMMAND. THE CREW WILL NOT INITIATE AN ABORT  
UNLESS THERE IS ON-BOARD VERIFICATION. THERE ARE BOTH MPS &  
OMS ENGINE OUT WARNING LITES ON THE MAIN PANEL. THERE ARE ALSO  
DEDICATED METERS FOR THESE ABORT PARAMETERS. HAZARD IS CLOSED.

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| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK CAT | H2D<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|-------------------------|------------|------------------|---------------|
| 1YXX-0503-20              | DISPLAYS-CONTROLS                   | CR                      | CN/CN 12   | CONTROLLED       | 022875        |

## HAZARD DESCRIPTION

IN AN ABORT SITUATION, THE "G" FORCES MAY BE TOO HIGH TO EFFECTIVELY USE THE CONTROLS AND DISPLAYS TO VERIFY AND INITIATE AN ABORT

| FLIGHT TEST<br>PRELAUNCH | GROUND TEST<br>LIFT OFF THRU ORBIT | FEKKY FLIGHTS<br>X ON ORBIT | ORBITAL MISSION X OTHER<br>DE-ORBIT THRU LANDING |
|--------------------------|------------------------------------|-----------------------------|--|
|                          |                                    |                             |  |

HAZARD GROUP FF LOSS OF FLIGHT CONTROL

RESP.ENGR. D.R.MC GRAW

RELATED FMEAS

FMEA REQD YES NO

NONE

X

REFERENCES

NONE

HAZARD CAUSES

IN AN ABORT SITUATION, SEVERAL SEQUENTIAL STEPS MAY BE NECESSARY TO CHECK-OUT THE CONDITION. ROTARY SWITCHES, CRT KEYBOARD AND PUSHBUTTON SWITCHES MAY HAVE TO BE OPERATED BY THE CREW.

HAZARD EFFECTS

AN UNNECESSARY DELAY MAY BE CREATED IN CREW RESPONSE TO A POSSIBLY TIME-CRITICAL ABORT SITUATION.



HAZARD NUMBER 1YXX-0503-20

RELATED HAZARD ANALYSES1YXX-0503-19HAZARD IDENTIFICATION CONCURRENCEFUNCTIONAL LEAD D.R. HAFNER

SAFETY LEAD W.E. PLAISTED

DISPOSITIONRESP GRP ACTION DOCUMENTATION

CREW SIMULATIONS HAVE INDICATED  
THAT REACH IS ACCEPTABLE UNDER  
3 "G" CONDITIONS; HOWEVER THIS  
ITEM WILL REMAIN OPEN UNTIL  
ALL THE ABORT RELATED CONTROLS  
AND DISPLAYS HAVE BEEN FIRMLY  
BASELINED

CLOSURE RATIONALE

ABORT CONTROLS AND DISPLAYS HAVE BEEN BASELINED AND THEY ARE  
ALL ACCESSIBLE TO THE CREW UNDER 3 "G" CONDITIONS. HAZARD IS  
CLOSED.

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | HZD<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1YXX-0503-21              | DISPLAYS-CONTROLS                   | CR                  | CN/CN 12   | CONTROLLED       | 022875        |

## HAZARD DESCRIPTION

ERRONEOUS ABORT SIGNAL ENERGIZES ABORT LIGHT RESULTING IN  
UNNECESSARY ABORT AND INCREASED RISK OF ACCIDENT

| FLIGHT TEST<br>PRELAUNCH | GROUND TEST<br>LIFT OFF THRU ORBIT | FERRY FLIGHTS<br>X ON ORBIT | ORBITAL MISSION<br>DE-ORBIT THRU LANDING | X OTHER |
|--------------------------|------------------------------------|-----------------------------|--|---------|
|                          |                                    |                             |  |         |

HAZARD GROUP FF LOSS OF FLIGHT CONTROL

RESP. ENGR. D.R. MCGRAW

## RELATED FMEAS

FMEA REQD YES NO

NONE

X

## REFERENCES

NONE

## HAZARD CAUSES

1. SINGLE TRANSDUCER FAILURE FOR ABORT PARAMETER OUTPUTS  
ERRONEOUS SIGNAL
2. SHORT CIRCUIT IN CONDITIONING CIRCUIT OR LIGHT

## HAZARD EFFECTS

THE REQUIRED TIME FOR A CREW RESPONSE TO AN ABORT LIGHT IS A  
FUNCTION OF MISSION PHASE. AT CRITICAL MODE BOUNDARIES, RAPID  
CREW ACTION TO INITIATE ABORT MODE IS ANTICIPATED. SELECTIVE  
DUMPING OF ORBITER/PAYLOAD PROPELLANTS AND PRESSURANTS MAY BE  
IMPLEMENTED; HOWEVER ABORT ACCIDENT POTENTIAL STILL EXISTS.

HAZARD NUMBER 1YXX-0503-21

RELATED HAZARD ANALYSES1YXX-0503-19HAZARD IDENTIFICATION CONCURRENCEFUNCTIONAL LEAD D.R. HAFNER

SAFETY LEAD W.E. PLAISTED

DISPOSITIONRESP GRP ACTION DOCUMENTATION

PROVIDE SUFFICIENT FLIGHT DIS-  
PLAYS FOR CREW TO MAKE ON-BOARD  
ABORT DECISION WITH POSSIBLE  
ASSISTANCE FROM GROUND STATIONS

390-700

NOTE: MCR 2030 INDICATES THAT  
AN ABORT WILL BE CREW INITIATED,  
MODE SELECTED AND VERIFIED AND  
THAT ADEQUATE DISPLAYS WILL BE  
PROVIDED FOR CREW TO PERFORM  
THESE FUNCTIONS

CLOSURE RATIONALE

THE ABORT LIGHT IS ONLY AN ADVISORY LIGHT FROM THE GROUND. IT  
WILL NOT CAUSE AN ABORT INITIATION UNLESS THE CREW VERIFIES THE  
CONDITION AND MANUALLY INITIATES THE ABORT ACTION. THE NECESSARY  
ABORT DISPLAYS AND CONTROLS ARE EASILY ACCESSIBLE TO THE CREW.

ORIGINAL PAGE IS  
OF POOR QUALITY

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| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | H2D<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1YXX-05C3-22              | DISPLAYS-CONTROLS                   | CR                  | CN/CN 12   | CONTROLLED       | 022875        |

## HAZARD DESCRIPTION

AN OMS ENGINE OUT CONDITION WILL TRIGGER AN ABORT LITE AND ALARM BUT THE SOLUTION TO THE PROBLEM MAY CONSIST OF AN EXTENDED OMS BURN RATHER THAN AN IMMEDIATE ABORT

| FLIGHT TEST | GROUND TEST         | FERRY FLIGHTS | ORBITAL MISSION       | X OTHER |
|-------------|---------------------|---------------|-----------------------|---------|
| PRELAUNCH   | LIFT OFF THRU ORBIT | X ON ORBIT    | DE-ORBIT THRU LANDING |         |

HAZARD GROUP FF LOSS OF FLIGHT CONTROL

RESP. ENGR. D.R. MCGRAW

RELATED FMEAS

FMEA REQD YES NO

NONE

X

REFERENCES

NONE

HAZARD CAUSES

AN OMS ENGINE OUT CONDITION IS ONE OF TWO CONDITIONS WHICH CAN RESULT IN AN INTACT ABORT. THEREFORE THE ABORT LITE AND AUDIBLE ALARM WILL ENERGIZE WITH A LOW THRUST CONDITION FROM AN OMS ENGINE, HOWEVER SUBSEQUENTLY THE ABORT PROGRAM MAY INDICATE THAT AN IMMEDIATE ABORT IS NOT NECESSARY.

HAZARD NUMBER 1YXX-0503-22

HAZARD EFFECTS  
-----

AN ABORT ALARM SHOULD BE A POSITIVE INDICATION THAT AN ABORT IS REQUIRED. A FALSE ALARM OR A DECISION THAT IS LATER REVERSED, MAY CAUSE THE CREW TO LOSE CONFIDENCE IN THE ALARM WHICH MAY LATER AFFECT CREW RESPONSE TIMES TO THE WARNING.

RELATED HAZARD ANALYSES  
-----

1YXX-0503-19

HAZARD IDENTIFICATION CONCURRENCE  
-----

FUNCTIONAL LEAD D.R. HAFNER

SAFETY LEAD W.E. PLAISTED

DISPOSITION  
-----RESP GRP ACTION DOCUMENTATION  
-----

PROVIDE SUFFICIENT C&W AND OTHER FLIGHT DISPLAY INFORMATION SO THAT CREW, WITH POSSIBLE BACK-UP GROUND STATION SUPPORT, CAN MAKE ABORT DECISION

390-700

NOTE: MCR 2030 INDICATES THAT THERE WILL NOT BE A COMPUTER GENERATED ABORT SIGNAL. ABORTS WILL BE SELECTED, INITIATED AND VERIFIED BY THE CREW AND NOT THE COMPUTER

CLOSURE RATIONALE  
-----

THE ABOVE CORRECTIVE ACTION HAS BEEN IMPLEMENTED IN THE DESIGN. THE ABORT LIGHT IS ONLY AN ADVISORY DISPLAY. THERE ARE ADEQUATE C&W ALARMS AND DEDICATED METERS FOR THE CREW TO DETECT AND INITIATE AN ABORT

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | H2D<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1YXX-0503-23              | DISPLAYS-CONTROLS                   | CR                  | CN/CN 12   | CONTROLLED       | 022875        |

## HAZARD DESCRIPTION

A HAZARDOUS LEVEL OF CARBON DIOXIDE DEVELOPS IN THE CABIN DUE TO FAILURE OF CO2 SCRUBBER EQUIPMENT AND CREW IS NOT ALERTED TO CONDITION BY AVIONICS EQUIPMENT

| FLIGHT TEST | GROUND TEST         | FERRY FLIGHTS | ORBITAL MISSION         | X OTHER |
|-------------|---------------------|---------------|-------------------------|---------|
| PRELAUNCH   | LIFT OFF THRU ORBIT | X ON ORBIT    | X DE-ORBIT THRU LANDING | X       |

HAZARD GROUP DD UNSAFE ENVIRONMENT

RESP. ENGR. D.R. MCGRAW

RELATED FMEAS

FMEA REQD YES NO

06-1-0341

X

REFERENCES

NONE

HAZARD CAUSES

THE REDUNDANT CO2 SCRUBBERS BECOME CONTAMINATED AND INEFFECTIVE. A FAILURE OF THE SINGLE CO2 SENSOR WOULD RESULT IN FAILURE TO ALERT CREW. IN ADDITION, THE MEASUREMENT IS NOT ON C&W BUT ON SYSTEM MANAGEMENT AND MAY NOT ALERT CREW TO HAZARD DURING SLEEP PERIOD.

HAZARD NUMBER 1YXX-0503-23

HAZARD EFFECTS

-----  
WHEN SCRUBBERS FAIL TO REMOVE CO2, THE CO2 LEVEL MAY INCREASE AT A FAST RATE. CO2 LEVEL ABOVE 3% MAY CAUSE SEVERE MEDICAL PROBLEMS RESULTING IN CREW UNCONSCIOUSNESS.

RELATED HAZARD ANALYSES

-----  
1ZXX-0601-01-01

HAZARD IDENTIFICATION CONCURRENCE

-----  
FUNCTIONAL LEAD J.H.COLEGROVE

SAFETY LEAD W.E.PLAISTED

DISPOSITION

-----  
RESP GRP ACTION DOCUMENTATION

PRELIMINARY ANALYSIS INDICATES THAT THE CARBON DIOXIDE LEVEL WOULD NOT INCREASE TO A DANGEROUS LEVEL DURING THE REPLACEMENT INTERVAL. THERE IS A CO2 CREW ALERT PARAMETER IN THE SYSTEMS MANAGEMENT NETWORK. IN ADDITION TO ALERTING THE CREW, THIS SIGNAL WILL BE TELEMETERED TO A GROUND STATION.

CLOSURE RATIONALE

-----  
THE ABOVE CORRECTIVE ACTION HAS BEEN CONFIRMED, THEREFORE THIS HAZARD IS CLOSED.

HA-TRACK

01/27/77 PAGE 1

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | HZD<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1YXX-0503-24              | DISPLAYS-CONTROLS                   | CA                  | 12         | DELETED          | 32675         |

HAZARD DESCRIPTION

LOSS OF FLIGHT CONTROL SYSTEM AND DOWNMOLING FROM AUTOMATIC TO  
MANUAL MODE DOES NOT RESULT IN VEHICLE CONTROL RECOVERY.  
(DELETED AND INCORPORATED INTO 1YXX-0505-02)

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| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT | HZD<br>TRACK | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------|--------------|------------------|---------------|
| 1YXX-0505-02              | DATA PROC.SYS-SOFTWR                | CA            | CN/CN 123    | CONTROLLED       | 102174        |

HAZARD DESCRIPTION

SINGLE FAULT LOADED INTO GENERAL PURPOSE COMPUTER APPEARS IN  
ALL GPC MEMORIES

| FLIGHT TEST       | GROUND TEST         | FERRY FLIGHTS | ORBITAL MISSION       | OTHER |
|-------------------|---------------------|---------------|-----------------------|-------|
| GROUND OPERATIONS |                     |               |                       | X     |
| PRELAUNCH X       | LIFT OFF THRU ORBIT | ON ORBIT      | DE-ORBIT THRU LANDING |       |

HAZARD GROUP FF LOSS OF FLIGHT CONTROLRESP.ENGR. R.F.RAASCHRELATED FMEAS

NONE

FMEA REQD YES NO

X

REFERENCES

NONE

HAZARD CAUSES

01-READ-IN/READ OUT ERROR FROM COMPUTER MEMORY  
02-INADVERTENT SOFTWARE BRANCHING  
03-ERROR IN SOFTWARE (PROGRAM TAPES) PROGRAMMED DATA  
04-CONFIGURATION (HARDWARE-TO-SOFTWARE) MISMATCH

HAZARD NUMBER 1YXX-0505-02

HAZARD EFFECTSABBERATIVE PROPULSION/FLIGHT CONTROL COMMAND COULD RESULT IN  
LOSS OF VEHICLE AND PERSONNELRELATED HAZARD ANALYSES

1AXX-0505-01, 1YXX-0507-04, 1YXX-0503-24, 1YXX-0507-05

HAZARD IDENTIFICATION CONCURRENCEFUNCTIONAL LEAD

SAFETY LEAD W.E.PLAISTED

DISPOSITIONRESP GRP ACTION DOCUMENTATIONBFCS IN OV-102 & SUBS CAN  
ALLEVIATE IMPACT OF SINGLE  
FAULT IN PFCS SOFTWARE

382-300 MCR 2634

CLOSURE RATIONALETHIS HAZARD IS CLOSED AS MCR 2634 IMPLEMENTS A BACKUP FLIGHT  
CONTROL SYSTEM WITH DEDICATED AVIUNIC HARDWARE AND DEDICATED  
SOFTWARE

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| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | HZD<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 12XX-0505-03              | DATA PROC. SYSTEM                   | CR CN/CN            | 2          | CONTROLLED       | 022175        |

## HAZARD DESCRIPTION

OVERLOADING OF SPACECRAFT ONBOARD COMPUTER CAPACITY

| FLIGHT TEST | GROUND TEST | FERRY FLIGHTS | ORBITAL MISSION | OTHER                   |
|-------------|-------------|---------------|-----------------|-------------------------|
| PRELAUNCH X | LIFT OFF    | THRU ORBIT X  | ON ORBIT X      | DE-ORBIT THRU LANDING X |

HAZARD GROUP FF LOSS OF FLIGHT CONTROL

RESP ENGR R.F. RAASCH

## RELATED FMEAS

FMEA REQD YES NO

NONE

X

## REFERENCES

SOFTWARE FSSR'S

## HAZARD CAUSES

- 01-FAILURE TO REMOVE INPUTS NOT BEING USED
- 02-FAILURE TO ADJUST MISSION TO COMPUTER CAPABILITIES AFTER REDUNDANT/BACKUP COMPUTER FAILURES

## HAZARD EFFECTS

FUNCTIONAL OPERATIONS ANOMOLIES IF CAPACITY EXCEEDED

## RELATED HAZARD ANALYSIS

NONE

HAZARD NUMBER 12XX-0505-03

HAZARD IDENTIFICATION CONCURRENCE

-----  
FUNCTIONAL LEAD -INTERFACE

SAFETY LEAD W.E.PLAISTED

DISPOSITION

RESP GRP ACTION DOCUMENTATION

-----  
SEE CLOSURE RATIONALE

CLOSURE RATIONALE

-----  
THIS HAZARD IS CLOSED AS THE "HAISE SCRUB" ADDRESSED THE  
OVERLOADING PROBLEM BY IMPLEMENTING A SOFTWARE PARTITIONING  
SCHEME WHEREIN THERE ARE SEPARATE LOADS FOR: ASCENT, ON-ORBIT,  
AND DESCENT. THESE LOADS ARE RESIDENT IN THE MASS MEMORY  
AND ARE TRANSFERRED IN/OUT OF THE GPC MEMORIES - DURING  
QUIESCENT PERIODS - AS THE MISSION NEEDS DICTATE

SAIL SIMULATION WILL ADDRESS ABILITY OF COMPUTER SYSTEM SIZING  
TO ACCOMMODATE MISSION SOFTWARE LOADING.

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SD77-SH-0001-06

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT | TRACK | HZD<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------|-------|------------|------------------|---------------|
| 12XX-0505-04              | DATA PROC HWE - DBC                 | CA            | CN/CN | 12         | CONTROLLED       | 051575        |

HAZARD DESCRIPTION

IGNITION SOURCE - DATA BUS COUPLER

| FLIGHT TEST        | GROUND TEST         | FERRY FLIGHTS | ORBITAL MISSION       | OTHER X |
|--------------------|---------------------|---------------|-----------------------|---------|
| ALL MISSION PHASES |                     |               |                       |         |
| PRELAUNCH          | LIFT OFF THRU ORBIT | ON ORBIT      | DE-ORBIT THRU LANDING |         |

HAZARD GROUP CC FIRE/EXPLOSIONRESP.ENGK R.F.RAASCHRELATED FMEASFMEA REQD YES NO

NONE

X

REFERENCES

MC409-0020

HAZARD CAUSES

01-COMPONENT SHORTING

02-EXTERNAL SURFACE TEMPERATURE IN EXCESS OF 352 DEGREES F

03-ARCING AND SPARKING

HAZARD EFFECTS

LOSS OF VEHICLE &amp; PERSONNEL FOLLOWING EXPLOSION

HAZARD NUMBER 1ZXX-0505-04

RELATED HAZARD ANALYSES

NONE

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD R.MATAKEDA

SAFETY LEAD W.E.PLAISTED

DISPOSITIONRESF GRP ACTION DOCUMENTATION

01-03 ANALYSIS IS REQUIRED TO  
ENSURE THAT THE DBC IS NOT AN  
IGNITION SOURCE IN ITS NOMINAL  
AND ANOMOLOUS OPERATIONS PER  
SD74-SH-0223B

383-410 SD74-SH-0223B

CLOSURE RATIONALE

HAZARD IS CLOSED AS ANALYSIS INDICATES THAT THE HIGHEST  
TEMPERATURE TO BE REACHED ON SURFACE OF DATA BUS COUPLER DOES  
MEET THE 352 DEGREES F SPECIFIED IN "ORBITER FIRE/TOXICITY SAFE-  
TY REQUIREMENTS" - SD74-SH-0223, REF: SINGER KEARFOTT Y258A355  
"THERMAL ANALYSIS" AND IL 383-41C-75-346 DATED 12 JUNE 1975

HAZARD DISPOSITION CONCURRENCEFUNCTIONAL SUPERVISION DEP-GRPDATESAFETY SUPERVISIONDATE

F.W.SPRINGE

F.J.ATTAWAY

071075

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SD77-SH-0001-06

HA-TRACK

01/27/77 PAGE 1

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | HZD<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1YXX-0506-03              | EPD&C-PYRO SYSTEM                   | CA CN/CN            | 012        | CONTROLLED       | 070974        |

HAZARD DESCRIPTION

MISFIRE OF NLG DEPLOY PYRO

| FLIGHT TEST | GROUND TEST         | FERRY FLIGHTS | ORBITAL MISSION         | X OTHER |
|-------------|---------------------|---------------|-------------------------|---------|
| PRELAUNCH   | LIFT OFF THRU ORBIT | X CN ORBIT    | X DE-ORBIT THRU LANDING | X       |

HAZARD GROUP FF LOSS OF FLIGHT CONTROL

RESP.ENGR. R.F.RAASCH

RELATED FMEAS

FMEA REQD YES NO

05-6B

X

REFERENCES

NONE

HAZARD CAUSES

- 01-SHORT CIRCUIT
- 02-INADVERTENT ACTUATION
- 03-LOSS OF ELECTRICAL POWER

HAZARD EFFECTS

INABILITY TO SAFELY ENTER ATMOSPHERE/OR FAILURE DURING ENTRY OF ATMOSPHERE: LOSS OF VEHICLE AND/OR CREW

RELATED HAZARD ANALYSES

1ZXX-0207-2B-01, 1ZXX-0207-2C, 1ZXX-0207-11A

HAZARD NUMBER 1YXX-0506-03

## HAZARD IDENTIFICATION CONCURRENCE

-----  
FUNCTIONAL LEAD J.LIVINGSTON

SAFETY LEAD W.E.PLAISTED

## DISPOSITION

RESP GRP ACTION DOCUMENTATION  
-----01-PROVIDE SHORT CIRCUIT IMMUNE  
INITIATE CIRCUITRY (PRESENT  
PYROS EMPLOY CAPACITIVE CHARGE  
FOLLOWING "ARM" INITIATE) PYRO  
FIRE CIRCUITRY IS SHIELDED TO  
PREVENT EMI "FIRE" INITIATE

392-610 VS70-510101

02-ACTUATE SWITCH (COMMANDER AND  
COPILOT POSITIONS) SPRING  
LOADED AND GUARDED TO PREVENT  
INADVERTENT ACTUATION

392-610 VS70-510101

03-DUAL INITIATION SYSTEMS ARE  
INSTALLED TO INITIATOR (PILOT  
STATION & COPILOT STATION)

392-610 VS70-510101

## CLOSURE RATIONALE

-----  
HAZARD HAS BEEN CLOSED AS ABOVE DESIGN REQUIREMENTS HAVE BEEN  
IMPLEMENTED PER VS70-510101

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| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | HZD<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1YXX-0506-04              | EPD&C-EVENTS CONTROL                | CA                  | CA/CN 123  | IN-WORK          | 080674        |

HAZARD DESCRIPTION

INADVERTENT PYRO FIRING/MISFIRING

| FLIGHT TEST        | GROUND TEST         | FERRY FLIGHTS | ORBITAL MISSION       | OTHER X |
|--------------------|---------------------|---------------|-----------------------|---------|
| ALL MISSION PHASES |                     |               |                       |         |
| PRELAUNCH          | LIFT OFF THRU ORBIT | ON ORBIT      | DE-ORBIT THRU LANDING |         |

HAZARD GROUP FF LOSS OF FLIGHT CONTROLRESP ENGR R.F.RAASCHRELATED FMEASFMEA REQD YES NO

05-6-2001,20034,20500-20512

REFERENCES

MC134 REV A -SEE CAUSES NOTED,MC450-0016,MC450-0040,MF0004-020

HAZARD CAUSES

- 01-UNNECESSARILY EARLY ARMING OF SYSTEMS (#2)
- 02-SEPARATION SENSORS WITH INADEQUATE TRAVEL TRIGGERED BY STRUCTURAL DEFLECTIONS (#33)
- 03-ALLOWING SIGNAL TO BE GENERATED BY MALFUNCTION OF A SINGLE SEPARATION SENSOR (#33)
- 04-UNNECESSARY DELAY IN DISARMING SYSTEMS WHEN THEY ARE NO LONGER NEEDED (#62)
- 05-ELECTRICAL TEST EQUIPMENT WITH VOLTAGE SOURCES HIGH ENOUGH TO FIRE PYRO DEVICES (#176)

HAZARD NUMBER 1YXX-0506-04

- 06-UNCONTROLLED OR INSUFFICIENTLY VERIFIED TEST TECHNIQUES USED TO DEMONSTRATE PYRO DEVICE INSENSITIVITY TO INITIATION BY STATIC CHARGES - TEST CAN PERMANENTLY LOWER RESISTANCE OF PYRO DEVICE TO INITIATION BY SUBSEQUENT STATIC CHARGES (#221)
- 07-HYGROSCOPIC MATERIALS IN CLOSE PROXIMITY TO EXPLOSIVES OR FIRING CIRCUITS (#260)
- 08-SNEAK CIRCUIT DURING UNGROUNDING SEQUENCE OF VEHICLE AT LIFT-OFF (#9)
- 09-FAILURE TO DEADFACE CIRCUITS INTERRUPTED BY GUILLOTINE CUTTERS AND PREVENT REMAINING PYRO FIRING (#44)
- 10-USE OF SHARED ARM/FIRE CIRCUITRY (#237)
- 11-FAILURE TO PROVIDE CONSPICUOUS IDENTIFICATION, BY COLOR CODE, OF ALL PYROTECHNIC DEVICES NOT INTENDED FOR FLIGHT USE (#211)
- 12-INABILITY TO CHECKOUT PYROTECHNIC CIRCUITS AFTER INSTL(7.1.6)
- 13-INADEQUATE ISOLATION OF PYROTECHNIC WIRING FROM THE OTHER SPACECRAFT WIRING(7.1.7)

## HAZARD EFFECTS

OFF DESIGN FIRING COULD CAUSE DAMAGE TO EQUIPMENT AND/OR LOSS OF ORBITER & PERSONNEL

## RELATED HAZARD ANALYSIS

1A6X-0506-01, 1A6X-0506-02, 1YXX-0506-03, 1ZXX-0506-15

## HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD KEN NICHOLS

SAFETY LEAD W.E. PLAISTED

## DISPOSITION

RESP GRP ACTION DOCUMENTATION

- 01-REQUIRE SPECIAL PROCEDURES
- 02-SEPARATION SENSORS NOT USED
- 03-SEE 02-ABOVE

NASA MISSION PROCEDURES

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## HAZARD NUMBER 1YXX-0506-04

|  |      |                      |
|--|------|----------------------|
| 04-REQUIRE SPECIAL PROCEDURES                          | NASA | MISSION PROCEDURES   |
| 05-REQUIRE SPECIAL PROCEDURES                          | NASA | TEST & CHECKOUT PROC |
| 06-REQUIRE SPECIAL PROCEDURES                          |      | TEST & CHECKOUT PROC |
| 07-INTERFACE-SEE HA 1ZXX-0506-23                       |      |                      |
| 08-SNEAK CIRCUIT ANALYSIS IN<br>PROCESS                |      |                      |
| 09-INTERFACE SEE HA 1ZXX-0506-10                       |      |                      |
| 10-SHARED ARM/FIRE CIRCUITRY NOT<br>EMPLOYED IN DESIGN |      | VS70-760502          |
| 11-REQUIRE SPECIAL PROCEDURES                          | NASA | TEST & CHECKOUT PROC |
| 12-REQUIRES SPECIAL PROCEDURES                         |      |                      |
| 13-WIRING TO BE SHIELDED PER<br>NASA JSC 08060         |      |                      |

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | H2D<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1ZXX-0506-05              | EPD&C-EVENTS CONTROL                | CR                  | CN/CN 12   | CONTROLLED       | 071174        |

HAZARD DESCRIPTIONINABILITY TO CLOSE SPEED BRAKE-ELECTRICAL CONTROL

| FLIGHT TEST<br>PRELAUNCH | GROUND TEST<br>LIFT OFF THRU ORBIT | FERRY FLIGHTS<br>ON ORBIT | ORBITAL MISSION<br>DE-ORBIT THRU LANDING | OTHER<br>X |
|--------------------------|------------------------------------|---------------------------|--|------------|
|--------------------------|------------------------------------|---------------------------|--|------------|

|  |                     |
|--|---------------------|
| HAZARD GROUP FF LOSS OF FLIGHT CONTROL | RESP.ENGR. R.RAASCH |
|--|---------------------|

RELATED FMEASFMEA REQD YES NO05-6ECXREFERENCESNONEHAZARD CAUSES01-LACK OF ELECTRICAL CONTROL/POWERHAZARD EFFECTSLOSS OF ENERGY/INABILITY TO REACH LANDING AREA, LOSS OF ORBITER  
AND CREWRELATED HAZARD ANALYSES1ZXX-0209-04-03

HAZARD NUMBER 1ZXX-0506-05

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD KEN NICHOLS

SAFETY LEAD W.E.PLAISTED

DISPOSITIONRESP GRP ACTION DOCUMENTATION01-PROVIDE REDUNDANT POWER AND/OR  
CONTROL TO SPEED BRAKE ACTU-  
ATOR PER VS70-790531

392-610 VS70-790531

CLOSURE RATIONALEHAZARD CLOSED AS REDUNDANT POWER AND ACTUATION HAVE BEEN PROVIDED  
PER VS70-790531HAZARD DISPOSITION CONCURRENCE

| <u>FUNCTIONAL SUPERVISION</u> | <u>DEP-GRP</u> | <u>DATE</u> | <u>SAFETY SUPERVISION</u> | <u>DATE</u> |
|-------------------------------|----------------|-------------|---------------------------|-------------|
| L.UPDEGRAFF                   | 392-610        | 062075      | F.J.ATTAWAY               | 071075      |

HA-TRACK

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| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT | HZD<br>TRACK | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------|--------------|------------------|---------------|
| 1ZXX-0506-06              | ELECT.PWR.DIST & CON                | CA            | CN/CN 123    | CONTROLLED       | 010375        |

HAZARD DESCRIPTION

FAILURE TO REQUIRE REDUNDANT RELAYS IN CRITICAL CIRCUITS

| FLIGHT TEST        | GROUND TEST         | FERRY FLIGHTS | ORBITAL MISSION       | OTHER X |
|--------------------|---------------------|---------------|-----------------------|---------|
| ALL MISSION PHASES |                     |               |                       |         |
| PRELAUNCH          | LIFT OFF THRU ORBIT | ON ORBIT      | DE-ORBIT THRU LANDING |         |

HAZARD GROUP FF LOSS OF FLIGHT CONTROL

RESP.ENGR. R.F.RAASCH

RELATED FMEAS

FMEA REQD YES NO

ALL 05-SERIES FMEAS

X

REFERENCES

MSC 00134 REV A #103

HAZARD CAUSES

01-LACK OF APPLICATION OF FO/FS OR FS CRITERIA TO CRITICAL CIRCUITRY

HAZARD EFFECTS

EQUIPMENT DAMAGE UP TO LOSS OF VEHICLE AND/OR CREW

RELATED HAZARD ANALYSES

NONE

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SD77-SH-0001-06

HAZARD NUMBER 1ZXX-0506-06

## HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD J.BEEKMAN

SAFETY LEAD W.E.PLAISTED

## DISPOSITION

RESP GRP ACTION DOCUMENTATION

01-RELIABILITY REDUNDANCY PROGRAM  
IS APPLIED TO ORBITER DESIGN  
AS A PROGRAM DISCIPLINE TO  
ENSURE A MINIMUM OF "FAIL  
SAFE" CRITERIA IMPLEMENTED  
PER MCR 955

394-100 MCR-955

## CLOSURE RATIONALE

HAZARD CLOSED AS REDUNDANCY IS REQUIRED IN ALL CRITICAL CIRCUITS  
PER MCR 955/ NHB 5300.4.1D301

## HAZARD DISPOSITION CONCURRENCE

| FUNCTIONAL SUPERVISION | DEP-GRP | DATE   | SAFETY SUPERVISION | DATE   |
|------------------------|---------|--------|--------------------|--------|
| H.SAKAI                | 394-103 | 062075 | F.J.ATTAWAY        | 071075 |

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | HZD<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1ZXX-0506-07              | ELEC.PWR.DIST.& CON                 | CR                  | CN/CN 23   | CONTROLLED       | 010375        |

HAZARD DESCRIPTION

IMPROPER LOCKING & SECURING OF ELECTRICAL CONNECTORS ON  
INSTALLATION

| FLIGHT TEST        | GROUND TEST         | FERRY FLIGHTS | ORBITAL MISSION       | OTHER X |
|--------------------|---------------------|---------------|-----------------------|---------|
| ALL MISSION PHASES |                     |               |                       |         |
| PRELAUNCH          | LIFT OFF THRU ORBIT | ON ORBIT      | DE-ORBIT THRU LANDING |         |

HAZARD GROUP XX EQUIPEMT DAMAGERESP ENGR R.E.RAASCHRELATED FMEASFMEA REQD YES NO

NONE

X

REFERENCES

MSC 00134 REV A #100

HAZARD CAUSES

IMPROPER INSTALLATION TECHNIQUES

HAZARD EFFECTS

EQUIPMENT DAMAGE

RELATED HAZARD ANALYSIS

1ZXX-0506-15



HAZARD NUMBER 1ZXX-0506-07

## HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD J.BERNICH

SAFETY LEAD W.E.PLAISTED

## DISPOSITION

RESP GRP

ACTION DOCUMENTATION

CONNECTORS ARE LOCKED AND SECURED  
PER PARAGRAPH 4.2. OF MLO303-0014

392-350

MLO303-0014 PER  
(SEE CLOSURE)

## CLOSURE RATIONALE

HAZARD CLOSED AS CORRECTIVE ACTION IS BEING IMPLEMENTED BY THE  
MLO303-0014 CALL OUT ON THE FOLLOWING DRAWINGS:

VO70-793001 CREW MODULE ELECTRICAL INSTL  
VO70-792001 LOWER FUSELAGE ELECTRICAL INSTL  
VO70-794000 MID FUSELAGE ELECTRICAL INSTL  
VO70-795000 AFT FUSELAGE ELECTRICAL INSTL  
VO70-796000 WING ELECTRICAL INSTL  
VO70-797000 VERTICAL ELECTRICAL INSTL

## HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP

DATE

SAFETY SUPERVISION

DATE

A.E.ROPER

392-350 061975

F.J.ATTAWAY

071075

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | HZD<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1ZXX-0506-08              | ELECT.PWR.DIST.& CON                | CA                  | CA/CN 123  | IN WORK          | 011675        |

## HAZARD DESCRIPTION

OFF SCHEDULE "ARMING" OR "DISARMING" CF SYSTEMS

| FLIGHT TEST        | GROUND TEST         | FERRY FLIGHTS | ORBITAL MISSION       | OTHER |
|--------------------|---------------------|---------------|-----------------------|-------|
| ALL MISSION PHASES |                     |               |                       | X     |
| PRELAUNCH          | LIFT OFF THRU ORBIT | ON ORBIT      | DE-ORBIT THRU LANDING |       |

HAZARD GROUP FF LOSS OF FLIGHT CONTROL

RESP.ENGR. R.F.RAASCH

## RELATED FMEAS

NONE

FMEA REQD YES NO

X

## REFERENCES

MSC 00134 REV A #2, #02, MCR 1816

## HAZARD CAUSES

01-SOFTWARE (PROGRAMMED DATA) IN ERROR OR ABSENT  
 02-PROCEDURAL DATA (MAN-MACHINE) IN ERROR OR ABSENT

## HAZARD EFFECTS:

POSSIBLE LOSS OF VEHICLE AND OR PERSONNEL

## RELATED HAZARD ANALYSIS

1ZXX- AND 1YXX- 0506 AND 0507 SERIES

HAZARD NUMBER 12XX-0506-08

HAZARD IDENTIFICATION CONCURRENCEFUNCTIONAL LEAD -INTERFACE

SAFETY LEAD W.E.PLAISTED

DISPOSITIONRESP GRPACTION DOCUMENTATION

01-MCR 1816 ESTABLISHES SOFTWARE  
WORKING GROUP TO EVALUATE  
UTILITY DATA FLOW - GUIDANCE,  
NAVIGATION AND CONTROL/SYSTEM  
MANAGEMENT - GROUND OPERATIONS  
AND THE NASA/IBM GENERATED  
FLIGHT TAPE

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MCR 1816

02-SUMMARIZE "MISSION PROCEDURES"  
FROM ALL HA'S THAT RELATE TO  
ARMING/DISARMING SYSTEM AND  
INCORPORATE IN FLIGHT DATA FILE

FLIGHT DATA FILE

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | HZD<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1ZXX-0506-09              | ELECT.PWR.DIST.& CON                | CR                  | CN/CN 23   | CONTROLLED       | 011675        |

## HAZARD DESCRIPTION

FAILURE TO PROTECT POWER SUPPLIES FROM SHORT CIRCUITS IN PYRO-  
TECHNIC DEVICES AFTER FIRING

| FLIGHT TEST        | GROUND TEST         | FERRY FLIGHTS | ORBITAL MISSION       | OTHER X |
|--------------------|---------------------|---------------|-----------------------|---------|
| ALL MISSION PHASES |                     |               |                       |         |
| PRELAUNCH          | LIFT OFF THRU ORBIT | ON ORBIT      | DE-ORBIT THRU LANDING |         |

HAZARD GROUP XX EQUIPMENT DAMAGE

RESP.ENGR. R.F.KAASCH

RELATED FMEAS

FMEA REQD YES NO

NONE

X

REFERENCES

MSC 00134 REV A #45, MC450-0018

HAZARD CAUSES

IMPROPER CIRCUIT PROTECTION

HAZARD EFFECTS

EQUIPMENT DAMAGE

RELATED HAZARD ANALYSIS

NONE

HAZARD NUMBER 1ZXX-0506-09

## HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD KEN NICHOLS

SAFETY LEAD W.E.PLAISTED

## DISPOSITION

RESP GRP

ACTION DOCUMENTATION

PYRO INITIATOR CONTROLLER REMOVES  
ARMING POWER AT FIRING PER  
SK5A1100001 AND REMOVAL OF FIRING  
SIGNALS OPENS BOTH LEGS OF INITI-  
ATOR CIRCUIT. THREE FAILURES RE-  
QUIRED TO ELIMINATE POWER SUPPLY  
PROTECTION

392-610

SK5A1100001

## CLOSURE RATIONALE

HAZARD CLOSED BASED ON IMPLEMENTATION OF THE CORRECTIVE ACTION  
NOTED ABOVE PER SK5A1100001

## HAZARD DISPOSITION CONCURRENCE

FUNCTIONAL SUPERVISION DEP-GRP

DATE

SAFETY SUPERVISION

DATE

L.A.UPDEGRAFF

392-610

062075

F.J.ATTAWAY

071075

150

SD77-SH-0001-06

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>ON OPERATION | LEVEL<br>INIT TRACK CAT | H2D<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE  |
|---------------------------|-------------------------------------|-------------------------|------------|------------------|----------------|
| 12XX-0306-10              | ELECT. PWR. LIST. & CON             | CR                      | CR/CR      | 13               | IN-WORK 002974 |

## HAZARD DESCRIPTION

FAILURE TO DEADFACE KU-BAND RADAR BUCM POWER CIRCUITS BEFORE  
GUILLOTINING/JETTISONING

FLIGHT TEST GROUND TEST FERRY FLIGHTS ORBITAL MISSION OTHER X  
ALL MISSION PHASES  
PRELAUNCH LIFT OFF THRU ORBIT ON ORBIT DE-ORBIT THRU LANDING

HAZARD GROUP XX EQUIPMENT DAMAGE

RESP ENGR R.F. KAASCH

RELATED FMEAS

FMEA REQD YES NO

NONE

X

REFERENCES

MSC 00134 REV A P44

HAZARD CAUSES

NO PROVISION FOR DEADFACING

HAZARD EFFECTS

EQUIPMENT DAMAGE

RELATED HAZARD ANALYSIS

NONE

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ORIGINAL PAGE IS  
OF POOR QUALITY

HAZARD NUMBER 12XX 0506-10

HAZARD IDENTIFICATION CONCURRENCE  
-----

FUNCTIONAL LEAD KEN NICHOLS

DISPOSITION  
-----PROCEDURE REQUIRED TO PULL  
CIRCUIT BREAKER PRIOR TO BCOM  
JFITISSJING

SAFETY LEAD W.E. PLAISTED

RESP GRP ACTION DOCUMENTATION  
-----FLIGHT DATA FILE  
PROCEDURESORIGINAL PAGE IS 152  
OF POOR QUALITY

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HA-TRACK

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| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT | TRACK | H2D<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------|-------|------------|------------------|---------------|
| 12XX-0506-11              | ELECT.PWR.DIST.& CUN                | CR            | CN/CN | 23         | CONTROLLED       | 080274        |

HAZARD DESCRIPTION

MATING/DEMATING ELECTRICAL CONNECTORS WITHOUT REMOVING VOLTAGES  
FROM THE POWERED SIDE OF THE CONNECTOR

| FLIGHT TEST X | GROUND TEST X       | FERRY FLIGHTS | ORBITAL MISSION       | OTHER |
|---------------|---------------------|---------------|-----------------------|-------|
| PRELAUNCH X   | LIFT OFF THRU ORBIT | ON ORBIT      | DE-ORBIT THRU LANDING |       |

HAZARD GROUP XX DAMAGE TO EQUIPMENT

RESP ENGR R.F.RAASCH

RELATED FMEAS

FMEA REQD YES NO

NONE

REFERENCES

MSC 00134 REV A #43

HAZARD CAUSES

- 01-UMBILICALS DISCONNECTED WHILE HOT
- 02- NO PROCEDURAL ACCOMMODATION TO SHUTDOWN EQUIPMENT PRIOR TO  
DEMATING/MATING CONNECTORS

HAZARD EFFECTS

DAMAGE TO EQUIPMENT - POSSIBLE IGNITION SOURCE

RELATED HAZARD ANALYSIS

NONE

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HAZARD NUMBER 1ZXX-0506-11

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD TOM QUEBEDEAUX

SAFETY LEAD W.E.PLAISTED

DISPOSITIONRESP GRP ACTION DOCUMENTATION

SEE CLOSURE RATIONALE

CLOSURE RATIONALE

THIS HAZARD IS CLOSED AS THE FOLLOWING IS CALLED OUT IN ALL TEST  
& CHECKOUT PROCEDURES: "G. ELECTRICAL CONNECTIONS SHALL NOT BE  
MATED/DEMATED WHILE VOLTAGE IS APPLIED TO CONNECTORS."

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT | HZD<br>TRACK | HAZD<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------|--------------|-------------|------------------|---------------|
| 1YXX-0506-12              | ELECT.PWR.DISTR&CON.                | CA            | CN/CN        | 12          | CONTROLLED       | 050575        |

## HAZARD DESCRIPTION

ET DOOR POWERING INVERTER FAILURE DURING RTLS ABORT IMPACT ON  
RETURN TO SITE

| FLIGHT TEST<br>PRELAUNCH | GROUND TEST<br>LIFT OFF | FERRY FLIGHTS<br>THRU ORBIT | ORBITAL MISSION<br>X ON ORBIT | OTHER<br>DE-ORBIT THRU LANDING |
|--------------------------|-------------------------|-----------------------------|-------------------------------|--------------------------------|
|--------------------------|-------------------------|-----------------------------|-------------------------------|--------------------------------|

|   |                       |
|---|-----------------------|
| HAZARD GROUP FF LOSS OF FLIGHT CONTROLS | RESP.ENGR. R.F.RAASCH |
|---|-----------------------|

## RELATED FMEAS

NONE

## FMEA REQD YES NO

X

## REFERENCES

RELIABILITY-AC POWER DISTRIBUTION SYSTEM LOAD ANALYSIS  
V560102

## HAZARD CAUSES

- 01-LOSS OF INVERTER POWERING ET DOORS(AND)
- 02-DOOR CLOSING TIMELINE IS EXTENDED (AND)
- 03-HIGH AERODYNAMIC PRESSURE DAMAGE TO ET DOOR
- 04-INCREASE AERODYNAMIC DRAG TO ORBITER

## HAZARD EFFECTS

INABILITY TO CLOSE ET DOOR COULD CAUSE AN AERODYNAMIC DRAG AND  
OR BUFFET SUFFICIENT IN MAGNITUDE TO PREVENT ABILITY TO  
TO RETURN TO SITE. LOSS OF VEHICLE AND PERSONNEL

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SD77-SH-0001-06

HAZARD NUMBER 1YXX-G506-12

RELATED HAZARD ANALYSIS

NONE

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD -INTERFACE-

SAFETY LEAD W.E.PLAISTED

DISPOSITIONRESP GRPACTION DOCUMENTATION

THE COMPRESSION LOADS ON THE ET  
DOOR LINKAGES ARE ALLEVIATED BY  
ADDING A TORQUE LIMITING OR  
DECLUTCHING DEVICE

MC287-0020  
PARA 3.2.1.2.1.2.1

CLOSURE RATIONALE

AFTER PITCH-UP DURING RTLS ABORT, THE DYNAMIC PRESSURE TENDS TO CLOSE THE ET DOORS. IN THE PREVIOUS DESIGN, ANY MOTOR POWERING FAILURE (THERE ARE TWO DRIVE MOTORS AND A DIFFERENTIAL DRIVE TRAIN) WOULD TEND TO COMPRESS THE DOOR LINKAGES AGAINST THE AERODYNAMIC DOOR CLOSING FORCE. SPECIFICATION REWRITE, AS NOTED, CALLS FOR A TORQUE LIMITING OR DECLUTCHING DEVICE TO ALLOW THE AERODYNAMIC PRESSURE TO AID IN DOOR CLOSING INSTEAD OF REACTING AGAINST THE DOOR CLOSING MOTOR.

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | H2D<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1ZXX-0506-13              | ELECT.PWR.DIST & CON                | CR                  | CN/CN 23   | CONTROLLED       | 011775        |

## HAZARD DESCRIPTION

CIRCUIT BREAKERS TOO LARGE OR SLOW ACTING TO PROTECT WIRING

| FLIGHT TEST        | GROUND TEST         | FERRY FLIGHTS | ORBITAL MISSION       | OTHER X |
|--------------------|---------------------|---------------|-----------------------|---------|
| ALL MISSION PHASES |                     |               |                       |         |
| PRELAUNCH          | LIFT OFF THRU ORBIT | ON ORBIT      | DE-ORBIT THRU LANDING |         |

HAZARD GROUP XX EQUIPMENT DAMAGE

RESP ENGR R.F.RAASCH

RELATED FMEAS

FMEA REQD YES NO

NONE

X

REFERENCES

MSC 00134 #3

HAZARD CAUSES

INADEQUATE DESIGN REQUIREMENTS

HAZARD EFFECTS

EQUIPMENT DAMAGE

RELATED HAZARD ANALYSIS

1ZXX-0506-24

HAZARD NUMBER 1ZXX-0506-13

HAZARD IDENTIFICATION CONCURRENCEFUNCTIONAL LEAD TOM QUEBEDEAUXSAFETY LEAD W.E.PLAISTEDDISPOSITIONRESP GRPACTION DOCUMENTATION

SELECTION OF WIRE GAGE VS BREAKER  
SIZE SPECIFIED IN IL TO DESIGNERS  
"SELECTION OF WIRE GAGES (MB 0150  
-048-KAPTON WIRE", 392-330-74-010  
DTD 7 JUNE 1976-REVISED

392-330

IL392-330-74-010

CLOSURE RATIONALE

THIS HAZARD IS CLOSED BASED ON DESIGN DIRECTION TO CONCERNED  
DESIGN GROUPS PRESENTED IN IL392-330-74-010 REV 7 JUNE 1976  
AND VERIFIED BY DESIGN SUPERVISION

HAZARD DISPOSITION CONCURRENCEFUNCTIONAL SUPERVISION DEP-GRPDATESAFETY SUPERVISIONDATE

L.A.UPDEGRAFF

392-330 062075

F.J.ATTAWAY

071075

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | H2D<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1ZXX-0506-14              | ELECT.PWR.DIST.& CON                | CR CR/CN            | 23         | IN WORK          | C10375        |

HAZARD DESCRIPTION

POWERING UP SYSTEMS WITH LATCHING RELAYS IN UNKNOWN POSITIONS

| FLIGHT TEST | GROUND TEST         | FERRY FLIGHTS | ORBITAL MISSION X     | OTHER |
|-------------|---------------------|---------------|-----------------------|-------|
| PRELAUNCH X | LIFT OFF THRU ORBIT | ON ORBIT      | DE-ORBIT THRU LANDING | X     |

HAZARD GROUP XX EQUIPMENT DAMAGERESP ENGR R.F.RAASCHRELATED FMEASFMEA REQD YES NO

NONE

X

REFERENCES

MSC 00134 REV A #99, #156

HAZARD CAUSES01-LATCHING RELAYS SWITCHED BY TRANSIENTS TO AN UNPLANNED  
CONFIGURATIONHAZARD EFFECTS

EQUIPMENT DAMAGE

RELATED HAZARD ANALYSIS

NONE

HAZARD NUMBER 12XX-0506-14

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD TOM QUEBEDEAUX

SAFETY LEAD W.E.PLAISTED

DISPOSITIONRESP GRPACTION DOCUMENTATION

LATCHING RELAYS IN DC/AC APPLI-  
CATIONS (POWER SWITCHING) HAVE  
AUXILIARY CONTACTS USED FOR POSI-  
TION INDICATION OF CONTACTORS

392-600

DESIGN PRACTICE

CONTACTOR POSITION CAN BE CALLED  
UP ON CRT/BARBER POLE INDICATORS

MISSION PROCEDURES

REMOTE CONTROL CIRCUIT BREAKERS  
CONTROL POWERED FROM ESSENTIAL  
BUS. POSITIONING IS A PROCEDURAL  
FUNCTION.

MISSION PROCEDURES

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | HZL<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 12XX-0506-15              | EPD&C-ORBITER WIRING                | CK                  | CN/CN 123  | CONTROLLED       | 010375        |

## HAZARD DESCRIPTION

DAMAGE SUSCEPTIBILITY TO ORBITER WIRING HARNESS

| FLIGHT TEST<br>ALL MISSION PHASES | GROUND TEST         | FERRY FLIGHTS | ORBITAL MISSION       | OTHER X |
|-----------------------------------|---------------------|---------------|-----------------------|---------|
| PRELAUNCH                         | LIFT OFF THRU ORBIT | ON ORBIT      | DE-ORBIT THRU LANDING |         |

HAZARD GROUP XX EQUIPMENT DAMAGE

RESP ENGR R.F. RAASCH

## RELATED FMEAS

FMEA REQD YES NO

NONE

X

## REFERENCES

MSC 00134 REV A #152, #174, #175, #93, #162, #150, #160, #180,  
MF0004-020, MCR 2931

## HAZARD CAUSES

- 01-UNPROTECTED WIREWAYS IN TRAFFIC AREAS (#152)
- 02-CLAMPING DISTANCES TOO LARGE TO PREVENT VIBRATION (#175)
- 03-SHARP WIRE TURNS ADJACENT TO CONNECTORS
- 04-ELECTRIC WIRING IN CONTACT WITH FLUID LINES/TANKS (#174)
- 05-FLAMMABLE POTTING IN ELECTRICAL CONNECTORS (#93)
- 06-CIRCUIT BREAKERS AND SWITCHES WITH FLAMMABLE CASES OR
- 07-POWER SYSTEM SURGES OUTSIDE TOLERABLE LIMITS RESULTING FROM  
EQUIPMENT TURN-ON OR TURN-OFF (#150)



HAZARD NUMBER 1ZXX-0506-15

- 08-HIGH RESISTANCE COATING DEPOSITED ON ELECTRICAL CONTACTS FROM OUTGASSED PRODUCTS OF POTTING COMPOUNDS AT ELEVATED TEMPERATURES AND LOW PRESSURES (#160)
- 09-SOLID WIRE (SINGLE STRAND) USE IN LOCATION SUSCEPTIBLE TO FLEXING.
- 10-SHARP EDGES THAT CAN CONTACT UNPROTECTED WIRE INSTAL.
- 11-HARNESS LENGTH AND ACCESS DOESN'T ALLOW DISCONNECT/RECONNECT OF WIRING OR CONNECTORS.

## HAZARD EFFECTS

IF NOT DISCOVERED IN TIME, LOSS OF VEHICLE AND PERSONNEL

## RELATED HAZARD ANALYSIS

1ZXX-0506-04, 1ZXX-0207-2B-C1, 1ZXX-0500-07

## HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD INTERFACE

SAFETY LEAD W.E.PLAISTED

## DISPOSITION

RESP GRP

ACTION DOCUMENTATION

- 01,10-DESIGN APPROACH DOES NOT ALLOW
- 011 EXPOSED WIRES IN CREW MODULE, & PAYLOAD BAY WIRES ARE IN SIDE MOUNTED WIRE TRAYS. APPROVAL OF WIRING MOCK-UP REQUIRED PER PARAGRAPH 3.4.OF MLO303-0014
- AFT FUS WIRING PER MCR 2931
- 02-SUPPORT AS SPECIFIED IN PARA 4.1.2 AND DESIGN INSPECTED PER PARAGRAPH 3.4.OF MLO303-0014
- 03-MINIMUM BEND RADIUS PER PARA 3.5.6. OF MLO303-0014 FOR WIRING HARNESS & COAXIAL CABLE

MLO303-0014

MCR 2931  
MLO303-0014

HAZARD NUMBER 1ZXX-0506-15

|  |             |
|--|-------------|
| 04-SEPARATION REQUIREMENT PER<br>PARAGRAPH 4.1.1.3. OF MLO303-<br>0014.  | MLO303-0014 |
| 05-CONNECTORS PROCURED TO 40M-<br>38227,40M38298,40M39569. 1N-<br>HOUSE CONNECTOR MATERIALS<br>SCREENED PER MF0004-003 | MF0004-003  |
| 06-INTERFACE-SEE HA 1ZXX-0500-07<br>FLAMMABILITY SCREENING PER<br>MC999-0096 REQUIRED BY GPPL<br>(MF0004-400)          | MF0004-400  |
| 07-POWER PROFILE DEFINITION REQD<br>BY PARA 3.2 OF MF0004-002 IN<br>EACH EQUIPMENT SPECIFICATION.                      | MF0004-002  |
| 08-SEE 05-ABOVE  |             |
| 09-IT IS COMPANY POLICY TO EXCLUDE<br>SINGLE STRAND WIRE BUYS UNLESS<br>SPECIFICALLY JUSTIFIED                         |             |

CLOSURE RATIONALE

HAZARD CLOSED PER INCLUSION OF REQUIREMENTS AND DESIGN SELECTION  
CRITERIA IN CORRECTIVE ACTION ABOVE PER MLO303-0014, CONNECTOR  
PROCUREMENT DOCUMENTS, MF004-003 AND MF0004-002 AND AS CALLED  
OUT IN THE FOLLOWING DRAWINGS:

V070-793001 CREW MODULE ELECTRICAL INSTL  
V070-792001 LOWER FORWARD FUSELAGE ELECTRICAL INSTL  
V070-794000 MID FUSELAGE ELECTRICAL INSTL  
V070-795000 AFT FUSELAGE ELECTRICAL INSTL  
V070-796000 WING ELECTRICAL INSTL  
V070-797000 VERTICAL ELECTRICAL INSTL

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ORIGINAL PAGE IS  
OF POOR QUALITY

HAZARD NUMBER 12XX-C506-15

HAZARD DISPOSITION CONCURRENCE

-----  
FUNCTIONAL SUPERVISION DEP-GRP

DATE

SAFETY SUPERVISION

DATE

-----  
-INTERFACE-

F.J.ATTAWAY

071075

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT | TRACK<br>CAT | H2D<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------|--------------|------------|------------------|---------------|
| 1YXX-0506-16              | EPD&C                               | CR            | CN/CN        | 23         | CONTROLLED       | 042875        |

## HAZARD DESCRIPTION

FAILURE TO RELEASE LH2/LG2 UMBILICAL

| FLIGHT TEST<br>PRELAUNCH | GROUND TEST<br>LIFT OFF | FERRY FLIGHTS<br>THRU ORBIT | ORBITAL MISSION<br>X ON ORBIT | OTHER<br>DE-ORBIT THRU LANDING |
|--------------------------|-------------------------|-----------------------------|-------------------------------|--------------------------------|
|--------------------------|-------------------------|-----------------------------|-------------------------------|--------------------------------|

HAZARD GROUP XX EQUIPMENT DAMAGE

RESP.ENGR. R.F.RAASCH

## RELATED FMEAS

FMEA REQD YES NO

NONE

X

## REFERENCES

NONE

## HAZARD CAUSES

IMPROPER SYSTEM DESIGN

## HAZARD EFFECTS

EQUIPMENT DAMAGE

## RELATED HAZARD ANALYSIS

NONE

HA-TRACK

01/27/77 PAGE 2

HAZARD NUMBER IYXX-0506-16

HAZARD IDENTIFICATION CONCURRENCE

-----  
FUNCTIONAL LEAD KEN NICHOLS

SAFETY LEAD W.E.PLAISTED

DISPOSITION

RESP GRF ACTION DOCUMENTATION

-----  
REDUNDANT PYRO DEVICES REQUIRED

-----  
VS760501

CLOSURE RATIONALE

-----  
REDUNDANT METHODS TO RELEASE UMBILICAL ARE AVAILABLE. THIS  
HAZARD IS CLOSED

166

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HA-TRACK

C1/27/77 PAGE 1

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | H2D<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1YXX-0506-17              | ELECT PWR.DIST & CON                | CR                  | CN/CN 2    | CONTROLLED       | 041874        |

HAZARD DESCRIPTION

LOSS OF ELECTRICAL POWER/CONTROL TO REMUTELY ACTUATED DOORS

| FLIGHT TEST<br>PRELAUNCH | GROUND TEST<br>LIFT OFF THRU | FERRY FLIGHTS<br>ORBIT X ON ORBIT | ORBITAL MISSION<br>DE-ORBIT THRU | OTHER<br>LANDING X |
|--------------------------|------------------------------|-----------------------------------|----------------------------------|--------------------|
|--------------------------|------------------------------|-----------------------------------|----------------------------------|--------------------|

|  |           |            |
|--|-----------|------------|
| HAZARD GROUP FF LOSS OF FLIGHT CONTROL | RESP ENGR | R.F.RAASCH |
|--|-----------|------------|

RELATED FMEAS

NONE

FMEA RECD YES NO

X

REFERENCES

NONE

HAZARD CAUSES

01-LACK OF REDUNDANT CONTROL/POWER OR BACK-UP SYSTEM

HAZARD EFFECTS

IF NOT CORRECTED, POSSIBLE LOSS OF VEHICLE AND CREW

RELATED HAZARD ANALYSIS

1ZXX-0201-1B; 1YXX-0204-1B; 1YXX-0204-2A ; 1YXX-C204-3A;  
1YXX-0211-1A,-2A,-3A,-4A,-5A,-6A,-7A, 1YXX-C211-04-01

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SD77-SH-0001-06

HAZARD NUMBER 1YXX-0506-17

HAZARD IDENTIFICATION CONCURRENCE  
-----

FUNCTIONAL LEAD JIM LIVINGSTON

SAFETY LEAD W.E.PLAISTED

DISPOSITION  
-----01-ADEQUATE POWER/CONTROL  
PROVIDED PER THE NOTED WIRING  
DIAGRAMSRESP GRP  
-----

392-600

ACTION DOCUMENTATION  
-----PAYLOAD BAY DOORS  
V540302  
ET DOORS  
V560102  
VENT DOORS  
V590502  
STAR TRACKER DOOR  
V590202CLOSURE RATIONALE  
-----THIS HAZARD IS CLOSED AS REDUNDANT METHODS FOR DOOR POWER AND  
CONTROL ARE AVAILABLE AS NOTED ABOVE

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | HZD<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 12XX-0506-18              | ELECT.PWR.DIST & CON                | CA                  | CN/CN 123  | CONTROLLED       | 041974        |

## HAZARD DESCRIPTION

BRAKES (MAIN LANDING GEAR) FAIL TO ACTUATE OR ACTUATE ERRATICALLY

| FLIGHT TEST<br>PRELAUNCH | GROUND TEST<br>LIFT OFF THRU ORBIT | FERRY FLIGHTS<br>ON ORBIT | ORBITAL MISSION<br>DE-ORBIT THRU LANDING | OTHER<br>X |
|--------------------------|------------------------------------|---------------------------|--|------------|
|                          |                                    |                           |  |            |

HAZARD GROUP FF LOSS OF CONTROL

RESP ENGR R.F.RAASCH

## RELATED FMEAS

NONE

FMEA REQD YES NO

X

## REFERENCES

VS70-520101

## HAZARD CAUSES

LACK OF REDUNDANT POWER/CONTROL CAPABILITY

## HAZARD EFFECTS

DAMAGE TO VEHICLE, POSSIBLE LOSS OF PERSONNEL

## RELATED HAZARD ANALYSIS

12XX-0201-3b, 12XX-0506-19



HAZARD NUMBER 12XX-G506-16

## HAZARD IDENTIFICATION CONCURRENCE

-----  
FUNCTIONAL LEAD JIM LIVINGSTON

SAFETY LEAD W.E.PLAISTED

## DISPOSITION

RESP GRP ACTION DOCUMENTATION

-----  
THREE OF FOUR BRAKED WHEELS RE-  
QUIRED FOR SPEC STOPPING. EACH  
BOGIE HAS TWO BRAKING SYSTEMS  
CONTROLLABLE BY EITHER PILOT OR  
COPLOT PER VS70-520101

392-610 VS70-520101

## CLOSURE RATIONALE

-----  
HAZARD CLOSED BASED ON REDUNDANT DESIGN AND OPERATIONAL OPTIONS  
AVAILABLE TO THE CREW IN THE EVENT OF BRAKE FAILURE AS SHOWN IN  
DRAWING VS70-520101

## HAZARD DISPOSITION CONCURRENCE

-----  
FUNCTIONAL SUPERVISION DEP-GRP DATE SAFETY SUPERVISION DATE  
-----  
L.A.UPDEGRAFF 392-610 062075 F.J.ATTAWAY 071075

HA-TRACK

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| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | H2D<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1ZXX-0506-19              | ELECT.PWR.DIST.& COM                | CA                  | CN/CN 123  | CONTROLLED       | 041974        |

HAZARD DESCRIPTION

NOSE GEAR STEERING SYSTEM LOSS OF CONTROL

| FLIGHT TEST<br>PRELAUNCH | GROUND TEST<br>LIFT OFF THRU ORBIT | FERRY FLIGHTS<br>ON ORBIT | ORBITAL MISSION<br>DE-ORBIT THRU LANDING | OTHER |
|--------------------------|------------------------------------|---------------------------|--|-------|
|                          |                                    |                           |  | X     |

HAZARD GROUP XX EQUIPMENT DAMAGE

RESP ENGR R.F.KAASCH

RELATED FMEAS

NONE

FMEA REQD YES NO

X

REFERENCES

NONE

HAZARD CAUSES

LACK OF ADEQUATE CONTRL/POWER REDUNDANCY OR OPERATIONAL BACK-UP

HAZARD EFFECTS

DAMAGE TO OR LOSS OF VEHICLE AND CREW

RELATED HAZARD ANALYSIS

1ZXX-0201-3B, 1ZXX-C506-18

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SD77-SH-0001-06

HAZARD NUMBER 1ZXX-0506-19

HAZARD IDENTIFICATION CONCURRENCEFUNCTIONAL LEAD JIM LIVINGSTONSAFETY LEAD W.E.PLAISTEDDISPOSITIONRESP GRPACTION DOCUMENTATIONSINGLE POWER/CONTROL SYSTEM  
BACKED UP BY DIFFERENTIAL BRAK-  
ING OF MAIN LANDING GEAR

392-610

VS70-510201

NLG STEERING SYSTEM INCORPORATES  
FAILURE DETECTION SYSTEM, FAILING  
INTO THE NLG "CASTER" MODE

388-301

MC621-0058

CLOSURE RATIONALEHAZARD IS CLOSED BASED ON DESIGN REDUNDANCY/BACK-UP THAT ALLOWS  
CREW MEMBERS TO RETAIN DIRECTIONAL CONTROL OF VEHICLE  
AS INDICATED IN CORRECTIVE ACTION ABOVE PER SPEC MC621-0058 AND  
DRAWING VS70-510201HAZARD DISPOSITION CONCURRENCEFUNCTIONAL SUPERVISION DEP-GRPDATESAFETY SUPERVISIONDATE

L.A.UPDEGRAFF

392-610

062075

F.J.ATTAWAY

071075

HA-TRACK

01/27/77 PAGE 1

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT | HZU<br>TRACK | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------|--------------|------------------|---------------|
| 1YXX-0506-20              | ELECT.PWR.DIST.& CON                | CR            | CN/CN 123    | CONTROLLED       | 102574        |

HAZARD DESCRIPTION

LOSS OF ELECTRICAL POWER/CONTROL TO PAYLOAD DEPLOY/RETRIEVAL SYS

| FLIGHT TEST<br>PRELAUNCH | GROUND TEST<br>LIFT OFF THRU ORBIT | FERRY FLIGHTS<br>ON ORBIT | ORBITAL MISSION<br>X DE-ORBIT | OTHER<br>THRU LANDING |
|--------------------------|------------------------------------|---------------------------|-------------------------------|-----------------------|
|--------------------------|------------------------------------|---------------------------|-------------------------------|-----------------------|

HAZARD GROUP XX EQUIPMENT DAMAGE

RESP ENGR K.F.RAASCH

RELATED FMEAS

FMEA REQD YES NO

NONE

X

REFERENCES

NONE

HAZARD CAUSES

LACK OF REDUNDANT POWER/CONTROL CAPABILITY

HAZARD EFFECTS

EQUIPMENT DAMAGE POSSIBLE RESULT IN INABILITY TO REENTER

RELATED HAZARD ANALYSIS

1YXX-0206-01, 1YXX-0206-02

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SD77-SII-0001-06

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | H2L<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1ZXX-0506-21              | ELECT PWR DIST & CON                | CA                  | CN/CN 123  | CONTROLLED       | 073074        |

## HAZARD DESCRIPTION

LOSS OF ELECTRICAL POWER/CONTROL TO RUDDER SUBSYSTEM

| FLIGHT TEST                           | GROUND TEST         | FERRY FLIGHTS | ORBITAL MISSION       | OTHER |
|---------------------------------------|---------------------|---------------|-----------------------|-------|
| ALL AERODYNAMIC FLIGHT MISSION PHASES |                     |               |                       | X     |
| PRELAUNCH                             | LIFT OFF THRU ORBIT | X ON ORBIT    | DE-ORBIT THRU LANDING | X     |

HAZARD GROUP FF LOSS OF FLIGHT CONTROL

RESP ENGR R.F. RAASCH

RELATED FMEAS

FMEA REQD YES NO

NONE

X

REFERENCES

MC621-00438

HAZARD CAUSES

01-LOSS OF POWER (ELECTRICAL)  
02-LOSS OF CONTROL

HAZARD EFFECTS

LOSS OF VEHICLE AND PERSONNEL

RELATED HAZARD ANALYSIS

1ZXX-0209-4A, 1ZXX-0209-4A-01,

HAZARD NUMBER 1ZXX-0506-21

HAZARD IDENTIFICATION CONCURRENCE  
-----

FUNCTIONAL LEAD R.E.ANTLETZ

SAFETY LEAD W.E.PLAISTED

DISPOSITION  
-----RESP GRP ACTION DOCUMENTATION  
-----01-POWER BY 3-28VDC BUS SEGMENTS  
FOR EACH OF FOUR SERVO-LOOP &  
VALVE DRIVERS PER PARAGRAPH  
10.10.1.2 OF MC621-00438

392-210 MC621-00438

02-CONTROLLED BY FOUR MDM INPUTS  
ONLY TWO OF WHICH ARE REQUIRED  
TO FUNCTIONAL PER 10.10.1.2.  
AS ABOVE

392-210 MC621-00438

CLOSURE RATIONALE  
-----HAZARD IS CLOSED BASED ON THE REDUNDANCY OF POWER, REDUNDANCY  
OF FUNCTION, AND FUNCTION ASSESSMENT CAPABILITY OF THE SUBSYSTEM  
PER SPECIFICATION MC621-00438HAZARD DISPOSITION CONCURRENCE  
-----

| FUNCTIONAL SUPERVISION | DEP-GRP | DATE   | SAFETY SUPERVISION | DATE   |
|------------------------|---------|--------|--------------------|--------|
| R.E.ANTLETZ            | 392-210 | 062075 | F.J.ATTAWAY        | 071075 |

HA-TRACK

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| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT | TRACK | HZD<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------|-------|------------|------------------|---------------|
| 1ZXX-0506-22              | ELECT PWR DIST & CON                | CA            | CN/CN | 123        | CONTROLLED       | 041674        |

HAZARD DESCRIPTION

LOSS OF ELECTRICAL POWER TO BODY FLAP

| FLIGHT TEST<br>PRELAUNCH | GROUND TEST<br>LIFT OFF | FERRY FLIGHTS<br>THRU ORBIT | ORBITAL MISSION<br>DE-ORBIT | OTHER<br>THRU LANDING |
|--------------------------|-------------------------|-----------------------------|-----------------------------|-----------------------|
|                          |                         | X                           |                             | X                     |

HAZARD GROUP FF LOSS OF FLIGHT CONTROL

RESP ENGR R.F. RAASCH

RELATED FMEAS

NONE

FMEA REQD YES NO

X

REFERENCES

MC621-00436

HAZARD CAUSES

- 01-LOSS OF POWER (ELECTRICAL)
- 02-LOSS OF CONTROL (ACTUATOR SIGNAL INPUT)
- 03-LOSS OF CONTROLLING SIGNAL (MDM PORT BLOCKAGE)

HAZARD EFFECTS

LOSS OF VEHICLE AND PERSONNEL

RELATED HAZARD ANALYSIS

01&02-1ZXX-0209-05 AND 1ZXX-0209-05-02; 03-1ZXX-0501-57

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SD77-SII-0001-06

HAZARD NUMBER 12XX-0506-22

HAZARD IDENTIFICATION CONCURRENCE  
-----

FUNCTIONAL LEAD R.E.ANTLETZ

SAFETY LEAD W.E.PLAISTED

DISPOSITION  
-----

RESP GRP

ACTION DOCUMENTATION  
-----

01-THREE 28VDC POWERED SECONDARY  
ACTUATORS PROVIDED. ONE ACTUA-  
TOR IS NECESSARY FOR CONTROL  
PER PARA 10.10.1.3. OF MC621-  
00438

392-210

MC621-00438

02-CONTROL TO ACTUATORS TRIPLY  
REDUNDANT PER ABOVE

392-210

MC621-00438

CLOSURE RATIONALE  
-----

HAZARD IS CLOSED BASED ON THE REDUNDANCY OF POWER, REDUNDANCY  
OF FUNCTION, AND FUNCTION ASSESSMENT CAPABILITY OF THE SUBSYSTEM  
PER MC621-00438

HAZARD DISPOSITION CONCURRENCE  
-----

FUNCTIONAL SUPERVISION DEP-GRP

DATE

SAFETY SUPERVISION

DATE  
-----

R.E.ANTLETZ

392-210 062075

F.J.ATTAWAY



HA-TRACK

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| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | H2O<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1YXX-0506-23              | ELECT PWR DIST&CONTR                | CA                  | CN/CN C12  | CONTROLLED       | 072176        |

HAZARD DESCRIPTION

LOSS OF ELECTRICAL POWER/CONTROL TO PAYLOAD RETENTION SYSTEM

FLIGHT TEST    GROUND TEST    FERRY FLIGHTS    ORBITAL MISSION X OTHER  
PRELAUNCH X   LIFT OFF THRU ORBIT X ON ORBIT X DE-ORBIT THRU LANDING X

HAZARD GROUP FF LOSS OF FLIGHT CONTROL

RESP.ENGR. R.F.RAASCH

RELATED FMEAS

FMEA REQD YES NO

NONE

X

REFERENCES

HAZARD CAUSES

01-LOSS OF POWER(ELECTRICAL)

02-LOSS OF CONTROL

HAZARD EFFECTS

RELEASE OF PAYLOAD IN OFF-DESIGN CONFIGURATION COULD CAUSE LOSS  
OF ORBITER/CREW

179

SD77-SH-0001-06

HAZARD NUMBER 1YXX-0506-23

## RELATED HAZARD ANALYSIS

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1Z7X-0205-2A

## HAZARD IDENTIFICATION CONCURRENCE

-----  
FUNCTIONAL LEAD JIM LIVINGSTONE SAFETY LEAD W.E.PLAISTED

## DISPOSITION

RESP GRP ACTION DOCUMENTATION

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01-PROVIDE REDUNDANT POWER

392-610

VS70-540202

02-PROVIDE REDUNDANT CONTROL  
CAPABILITY

392-610

VS70-540202

## CLOSURE RATIONALE

-----  
PAYLOAD LATCH DRIVERS INCORPORATE TWO MOTORS, EACH POWERED FROM  
A DIFFERENT BUS. THREE STAGE TURN-ON (POWER-SELECT FUNCTION - AND  
ACTUATE) MINIMIZES INADVERTENT ACTUATION. POWER/CONTROL LOSS IN  
LATCHED STATE IS FAIL-SAFE. THIS HAZARD IS CLOSED, AS REPRESENTA-  
TIVE CIRCUITRY IS SHOWN SCHEMATICALLY IN VS70-540202 IMPLEMENT-  
ING THE CORRECTIVE ACTION ITEMS ABOVE

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | HZD<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1ZXX-0507-01              | AVIONICS COMPUTER                   | CA                  | CN/CN 123  | CONTROLLED       | 042274        |

## HAZARD DESCRIPTION

A POWER INTERRUPTION OF GREATER THAN 400 MICROSECONDS CAUSES INITIATION OF COMPUTER SHUTDOWN. ONCE SHUTDOWN IS INITIATED, NO ATTEMPT AT RESTART WILL BE MADE

| FLIGHT TEST X GROUND TEST | FERRY FLIGHTS                  | ORBITAL MISSION X OTHER |
|---------------------------|--------------------------------|-------------------------|
| PRELAUNCH                 | LIFT OFF THRU ORBIT X ON ORBIT | DE-ORBIT THRU LANDING X |

| HAZARD GROUP | FF LOSS OF FLIGHT CONTROL | RESP. ENGR R. RAASCH |
|--------------|---------------------------|----------------------|
|              |                           |                      |

## RELATED FMEAS

05-6S

FMEA REQD YES NO

X

## REFERENCES

MC615-0001 PARA. 3.2.1.5.3

## HAZARD CAUSES

01-LIGHTNING STRIKE  
02-SNEAK CIRCUIT PROBLEMS  
03-SHOCK AND VIBRATION

## HAZARD EFFECTS

LOSS OF ORBITER AND PERSONNEL

## RELATED HAZARD ANALYSES

1ZXX-0401-04

HAZARD NUMBER 1ZXX-0507-01

HAZARD IDENTIFICATION CONCURRENCEFUNCTIONAL LEAD R.P.D'EVELYNSAFETY LEAD W.E.PLAISTEDDISPOSITIONRESP GRP ACTION DOCUMENTATION

01-03-MULTIPLE DC BUS SEGMENTS  
TO PRECLUDE COMPLETE  
POWER LOSS OR INTERRUPT AND  
CONNECT POWER INTERRUPTION  
SENSITIVE EQUIPMENT TO THESE  
MULTIPLE BUS SEGMENTS AND EN-  
SURE TWO OR MORE SOURCES OF  
DC POWER TO COMPUTATIONAL  
EQUIPMENT AT ALL TIMES PER  
VS70-720211, VS70-720221,  
VS70-720231

392-610 VS70-720211  
VS70-720221  
VS70-720231

CLOSURE RATIONALE

HAZARD IS CLOSED AS POWER INTERRUPTION IS NOT CREDIBLE BASED  
ON APPROACH TAKEN IN CORRECTIVE ACTION NOTED ABOVE TO PREVENT  
POWER INTERRUPT AS INDICATED IN THE FOLLOWING LISTED WIRING  
DIAGRAMS:

VS70-720211 MASS MEMORY  
VS70-720221 GPC POWER & CONTROL  
VS70-720231 GPC SYNCHRONIZATION & FAILSAFE

HAZARD DISPOSITION CONCURRENCE

| <u>FUNCTIONAL SUPERVISION</u> | <u>DEP-GRP</u> | <u>DATE</u> | <u>SAFETY SUPERVISION</u> | <u>DATE</u> |
|-------------------------------|----------------|-------------|---------------------------|-------------|
| L.A.UPDEGRAFF                 | 392-610        | 062075      | F.J.ATTAWAY               | 071075      |

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT | HZD<br>TRACK | HAZARD<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------|--------------|---------------|------------------|---------------|
| 12XX 0507-02              | AVIONICS COMPUTER                   | CA            | CA/CN        | 123           | DELETED          | 041574        |

HAZARD DESCRIPTION

DATA IN CORE BECOMES SCRAMBLED ALL COMPUTERS VOTE EACH OTHER OFF  
THE LINE (REQUIRES FOUR SIMULTANEOUS FAILURES. BEYOND FO/FS  
REQUIREMENTS

HA-TRACK

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| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | HZO<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1YXX-0507-05              | AVIONICS COMPUTER                   | CA                  | 123        | DELETED          | 110174        |

HAZARD DESCRIPTION

LOSS OF COMPUTER OUTPUT/ALL COMPUTERS (102 & SUBS)  
(THIS HAZARD IS INCORPORATED IN 1YXX-0505-02)

| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | H2D<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1ZXX-0507-03              | AVIONICS COMPUTER                   | CA                  | CN/CN 123  | CONTROLLED       | 041974        |

## HAZARD DESCRIPTION

IF AN ERROR OCCURS IN THE FLIGHT CONTROL SOFTWARE AND MANUAL  
OVERRIDE IS ATTEMPTED, THE RESULT WILL BE A LOSS OF CONTROL

FLIGHT TEST X GROUND TEST FERRY FLIGHTS ORBITAL MISSION X OTHER  
PRELAUNCH LIFT OFF THRU ORBIT X ON ORBIT DE-ORBIT THRU LANDING X

HAZARD GROUP FF LOSS OF FLIGHT CONTROL RESP. ENGR R.RAASCH

## RELATED FMEAS

FMEA REQD YES NO

NONE

X

## REFERENCES

MJ 070-0001-1 ORBITER CEI SPEC.PARA-3.3.5.5.1.1.1.

## HAZARD CAUSES

A SOFTWARE BUG COULD THROW FLIGHT CONTROL SOFTWARE INTO  
UNEXPECTED BEHAVIOR. MANUAL OVERRIDE INPUTS TO THE SAME SOFTWARE

## HAZARD EFFECTS

LOSS OF ORBITER AND PERSONNEL

## RELATED HAZARD ANALYSES

1ZXX-0507-01; 1ZXX-0101-01-01,-02,-03; 1AXX-0502-05,-11,-12.

HAZARD NUMBER 12XX-0507-03

HAZARD IDENTIFICATION CONCURRENCE

FUNCTIONAL LEAD R.P.D'EVELYN

SAFETY LEAD W.E.PLAISTED

DISPOSITIONRESP GRP ACTION DOCUMENTATIONPROVIDE A BACKUP FLIGHT CONTROL  
SYSTEM TO BYPASS REDUNDANT GPC  
SOFTWARE GENERIC FAULT

393 MCR 901 REV A

RISK CAN BE REDUCED THROUGH  
EXTENSIVE TESTING OF SOFTWARE  
DURING DEVELOPMENT (ADL/SAIL).

384-400

CLOSURE RATIONALEHAZARD CLOSED BASED ON AVAILABILITY OF BFCS PER MCR 901 REV A  
AND SUBSEQUENT DEVELOPMENT AND TESTING OF SOFTWAREHAZARD DISPOSITION CONCURRENCE

| <u>FUNCTIONAL SUPERVISION</u> | <u>DEP-GRP</u> | <u>DATE</u> | <u>SAFETY SUPERVISION</u> | <u>DATE</u> |
|-------------------------------|----------------|-------------|---------------------------|-------------|
| F.W.SPRINGE                   | 383-400        | 062075      | F.J.ATTAWAY               | 071075      |



| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT TRACK | HZD<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------------|------------|------------------|---------------|
| 1YXX-0507-04              | AVIONICS COMPUTER                   | CA                  | CN/CN 123  | ELIMINATED       | 110174        |

## HAZARD DESCRIPTION

ABERRATIVE COMPUTER OUTPUT-FIRING COMMANDS TO RCS WHEN STOWED

FLIGHT TEST GROUND TEST FERRY FLIGHTS CREITAL MISSION X OTHER  
PRELAUNCH X LIFT OFF THRU ORBIT X ON ORBIT X DE-ORBIT THRU LANDING X

## HAZARD GROUP CC FIRE/EXPLOSION

RESP. ENGR R.F. RAASCH

## RELATED FMEAS

FMEA REQD YES NO

02-4-041000

X

## REFERENCES

MC467-0028, MC467-0029

## HAZARD CAUSES

01-LOAD OF SOFTWARE (PROGRAM) WITH FAULT INTO MASS MEMORY  
(SINGLE POINT SOFTWARE GENERIC ERROR)

## HAZARD EFFECTS

LOSS OF VEHICLE AND/OR PERSONNEL THROUGH FIRE/EXPLOSION IN RCS  
COMPARTMENT

## RELATED HAZARD ANALYSES

1YXX-0302-03, 1YXX-0505-02

HAZARD NUMBER 1YXX-0507-04

HAZARD IDENTIFICATION CONCURRENCE

-----  
FUNCTIONAL LEAD R.P.D'EVELYN

SAFETY LEAD W.E.PLAISTED

DISPOSITION

-----  
01-RISK CAN BE REDUCED THROUGH  
EXTENSIVE TESTING OF SOFTWARE  
DURING DEVELOPMENT(ADL/SAIL)

RESP GRP ACTION DOCUMENTATION

-----  
384-400CONSIDER OPERATIONAL PRO-  
CEDURES TO DISABLE RCS DUR-  
ING CRITICAL MISSION PHASES

CLOSURE RATIONALE

-----  
RCS DOOR REMOVED PER MCR 1746. HAZARD NO LONGER EXISTS, HAS BEEN  
ELIMINATED

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| HAZARD ANALYSIS<br>NUMBER | SUBSYSTEM/EQUIPMENT<br>OR OPERATION | LEVEL<br>INIT | H2D<br>TRACK | HAZARD<br>CAT | HAZARD<br>STATUS | ENTRY<br>DATE |
|---------------------------|-------------------------------------|---------------|--------------|---------------|------------------|---------------|
| 12XX-0507-06              | COMPUTER SYSTEM                     | CR            | CN/CN        | 023           | CONTROLLED       | 012175        |

HAZARD DESCRIPTION

USE OF "LOC-TITE" IN APPLICATION WHERE IT CAN COME INTO CONTACT  
WITH MAGNETIC TAPE

| FLIGHT TEST        | GROUND TEST         | FERRY FLIGHTS | ORBITAL MISSION       | OTHER |
|--------------------|---------------------|---------------|-----------------------|-------|
| ALL MISSION PHASES |                     |               |                       | X     |
| PRELAUNCH          | LIFT OFF THRU ORBIT | ON ORBIT      | DE-ORBIT THRU LANDING |       |

| HAZARD GROUP | FF | LOSS OF FLIGHT CONTROL | RESP ENGR | R.F. RAASCH |
|--------------|----|------------------------|-----------|-------------|
|              |    |                        |           |             |

RELATED FMEAS

NONE

FMEA REQD YES NO

X

REFERENCES

MSC 00134 REV A #220, IL NO.383-420-75-185 , MC615-0005

HAZARD CAUSES

01-"LOCTITE" CONTAINS CHEMICALS WHICH DAMAGE THE IRON OXIDE  
COATING OF THE MAGNETIC TAPE

HAZARD EFFECTS

DAMAGE TO TAPE AND INFORMATION STORED THEREON

HAZARD NUMBER 12XX-0507-06

## RELATED HAZARD ANALYSIS

-----  
NONE

## HAZARD IDENTIFICATION CONCURRENCE

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FUNCTIONAL LEAD INTERFACE  
DISPOSITION01-APPLICATIONS OF "LOCTITE"  
USAGE TO BE CONTROLLED BY  
NOTIFYING MASS MEMORY SUPPLIERSAFETY LEAD W.E.PLAISTED  
RESP GRP ACTION DOCUMENTATION  
-----383-400 MC615-0005 SCDR  
RID NO.1-13-D2-01

## CLOSURE RATIONALE

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THIS HAZARD IS CLOSED BASED ON CLOSURE OF THE SUBJECT RID (GAMMA  
FERRIC OXIDE TAPE NOT AFFECTED - RE IBM IL HOLMES FROM KERINS  
DATED 12 JUNE 1975-002BC66) NOTE: GAMMA FERRIC OXIDE TAPE TO BE  
USED ON THIS PROGRAM IS DESIGNATED 3M 900

## HAZARD DISPOSITION CONCURRENCE

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FUNCTIONAL SUPERVISION DEP-GRP DATE SAFETY SUPERVISION DATE  
-----  
F.W.SPRINGE 383-400 062675 F.J.ATTAWAY 070775